Appendix D

Parcel A Post-Demolition Risk Assessment, Integrated Environmental Services, Inc., March 1998 (on Compact Disc)

HALEY & ALDRICH

INTEGRATED
Environmental Services, Inc.

Post-Demolition Risk Assessment

Boeing Realty Corporation
C-6 Facility, Parcel A

Los Angeles, California
March 6, 1998

BOEING

BOE-C6-0058502

File No:	109-1
Date:	March 6, 1998
Title:	Post Demolition Risk Assessment, Parcel A
Author:	Integrated Environmental Services, Inc.
Description:	This risk assessment evaluates the potential health risks to future users of Parcel A and identifies any localized "hot spots" requiring further remediation.
Location of Item:	Drawer No. 30D

RECEIVED
APR 20 1998
BOEING REALTY CORPORATION

INTEGRATED
Environmental Services, Inc.

April 13, 1998

Via Facsimile and Federal Express

James E. Ross, P.E.
Unit Chief, Site Cleanup Unit
Regional Water Quality Control Board
Los Angeles Region
101 Center Plaza Drive
Monterey Park, CA 91754-2156

Subject: Response to RWQCB Memo re. *Post-Demolition Risk Assessment*, March 31, 1998

Project: Boeing C-6 Facility, Parcel A, Los Angeles (RWQCB File No. 100.315)

Dear Mr. Ross:

On behalf of Boeing Realty Corporation, Integrated Environmental Services Inc. is pleased to submit for your review the attached document pertaining to the C-6 facility, Parcel A. We are delighted to report that the incorporation of the Regional Water Quality Control Board's (RWQCB's) review comments has resulted in a reduction of projected risks. However, the fundamental finding of the risk assessment, "no significant risk," has not been altered. The proposed change pages for the RWQCB comments have been enclosed for your review. In addition, this document has been prepared so that it may be incorporated into the final post-demolition risk assessment front matter.

Comment 1: Our Calculation for the following equations, using the data provided, indicated the following:

Equation	*Site-specific soil parameters*	*PDRA soil parameters*
5-5 (g/cm3)	*1.45E-3*	*2.63E-3*
5-12 (mg/cm2-s)	*2.32E-15*	*7.32E-13*

Please provide recalculations of the above and enter the appropriate values.

Response: Equation 5-5 of the post-demolition risk assessment should read as follows:

$$K_{as} = H'/(R \times T \times K_d) \qquad (5\text{-}5)$$

where

H'	=	COPC-specific Henry's Law constant (atm-m^3/mol), from Table 5-3
R	=	ideal gas constant, 8.206 x 10^{-5} atm-m^3/mol/K
T	=	temperature in Kelvin, 293 K
K_d	=	soil-to-water partitioning coefficient (cm^3/g), K_{OC} from Table 5-3 times fraction of organic carbon in soil matrix, 0.004 unitless (Cal/EPA 1994)

3990 Westerly Place, Suite 210 ◆ Newport Beach, CA 92660 ◆ Tel: (714) 852-9050 ◆ Fax: (714) 852-9011

INTEGRATED
Environmental Services, Inc.

March 20, 1998

Via Facsimile and Federal Express

James E. Ross, P.E.
Unit Chief, Site Cleanup Unit
Regional Water Quality Control Board
Los Angeles Region
101 Center Plaza Drive
Monterey Park, CA 91754-2156

Subject: Response to RWQCB Memo re. *Post-Demolition Risk Assessment*, March 13, 1998

Project: Boeing C-6 Facility, Parcel A, Los Angeles (RWQCB File No. 100.315)

Dear Mr. Ross:

Integrated has reviewed the comments prepared by the Water Board and has prepared the following materials to further address the remaining two comments.

Comment 1: *To evaluate the chemical concentration data, as discussed, we require statistical soil data for the following constituents of potential concern (COPCs) in Table 2-1 (page 2-10): 1,1-dichloroethylene, aroclor 1248, aroclor 1260, benzo(b)fluoranthene, dibenco(a,h)anthrancene, naphthalene, tetrachloroethylene, trichloroethylene, total xylenes, and arsenic. Please provide us with the following data for the COPCs listed:*

a) *a histogram plot of field soil data to show distribution.*
b) *the D'Agostino's test results to show either the normal or log-normal distribution.*

Response: The data set used in the derivation of exposure point concentrations includes over 200,000 records as presented in Supplemental Books 1-5 of the March 6, 1998, version of the Post-Demolition Risk Assessment (PDRA). Integrated has performed numerous statistical evaluations of the data set prior to the development of the PDRA. The following addresses the RWQCB requested statistical analyses.

a) a histogram plot of field soil data to show distribution

Histograms have been prepared for each of the COPCs as requested by RWQCB in Figures 1-14. A third party statistical analysis software package, *Statistica*™, by StatSoft was used to analyze the COPC hits. Histograms could not be developed for Aroclor-1248, Aroclor-1260, and dibenzo(a,h)anthracene due to their extremely limited detection frequency. These organics were each detected a total of five times in Parcel A. However, these organics have been assumed to be distributed in an identical manner to the other organic constituents evaluated in the PDRA.

Arsenic was the only COPC anticipated to exist throughout the site and thus demonstrate a normal distribution. All other COPCs (organics) were assumed log normally distributed. The enclosed figures demonstrate that the assumptions used in the PDRA concerning the distribution of organic and inorganic constituents at the site where acceptable.

James Ross
March 20, 1998

Figure 1
Fit-Test Distribution Histogram: Assumed Normal

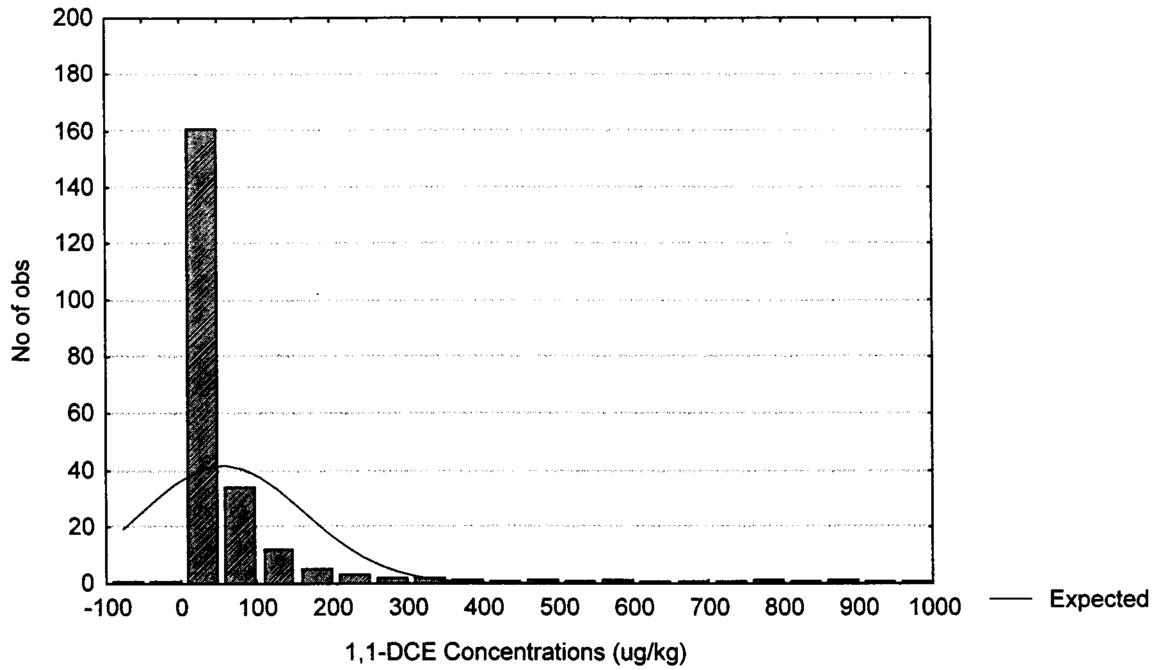


Figure 2
Fit-Test Distribution Histogram: Assumed Lognormal

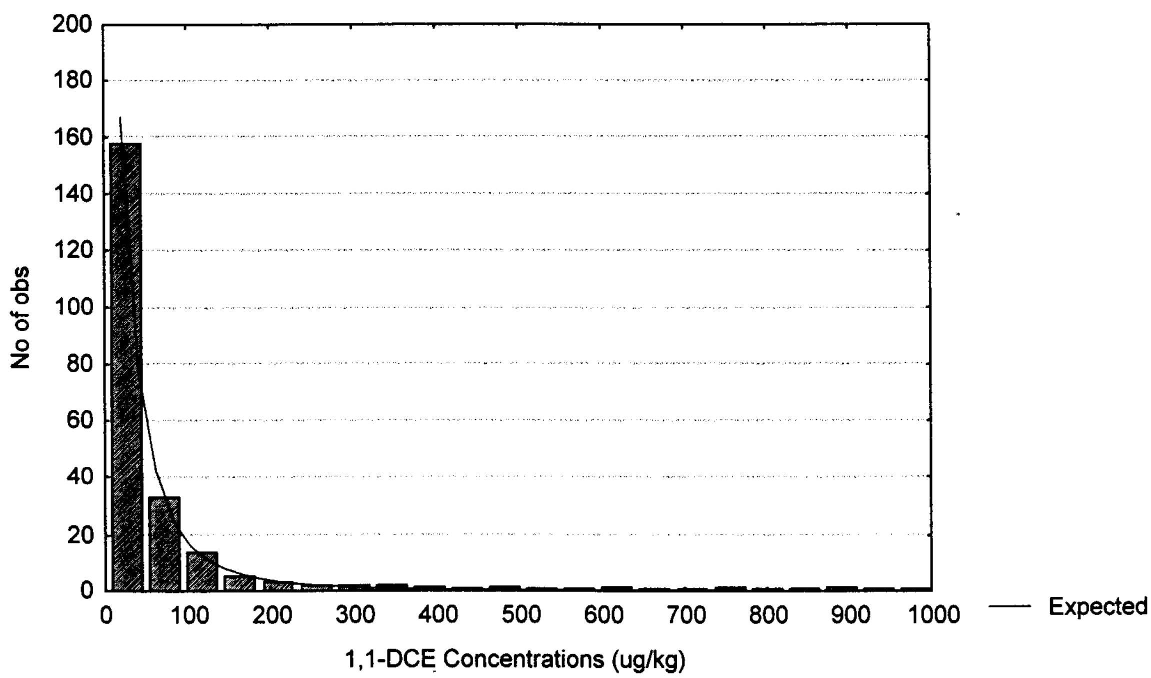


Figure 3
Fit-Test Distribution Histogram: Assumed Normal

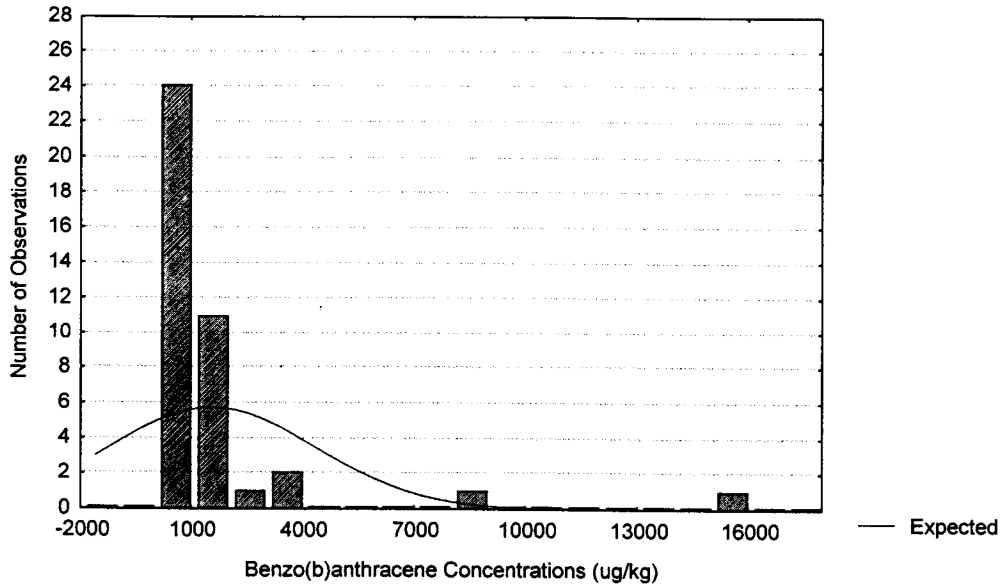
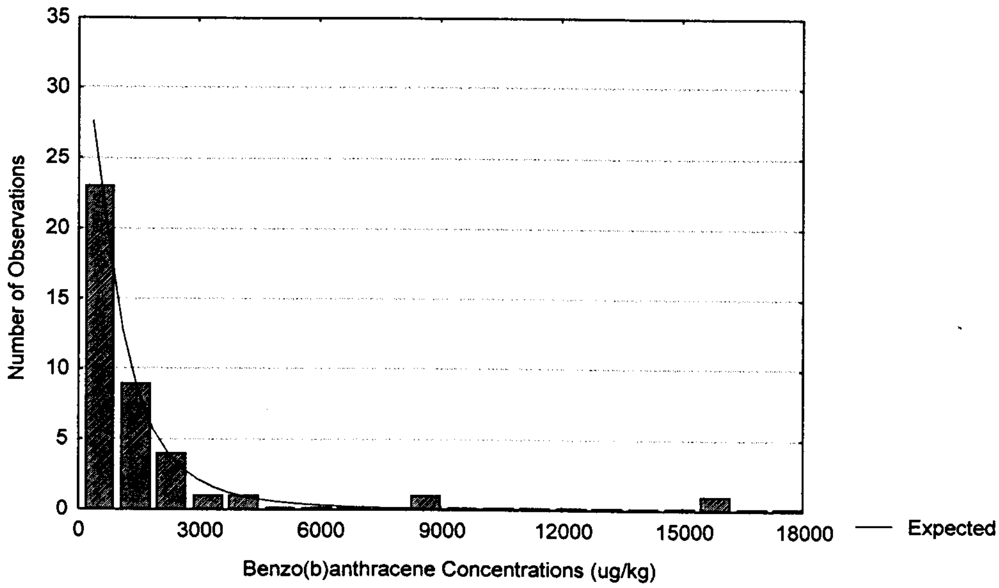


Figure 4
Fit-Test Distribution Histogram: Assumed Lognormal



James Ross
March 20, 1998

Figure 5
Fit-Test Distribution Histogram: Assumed Normal

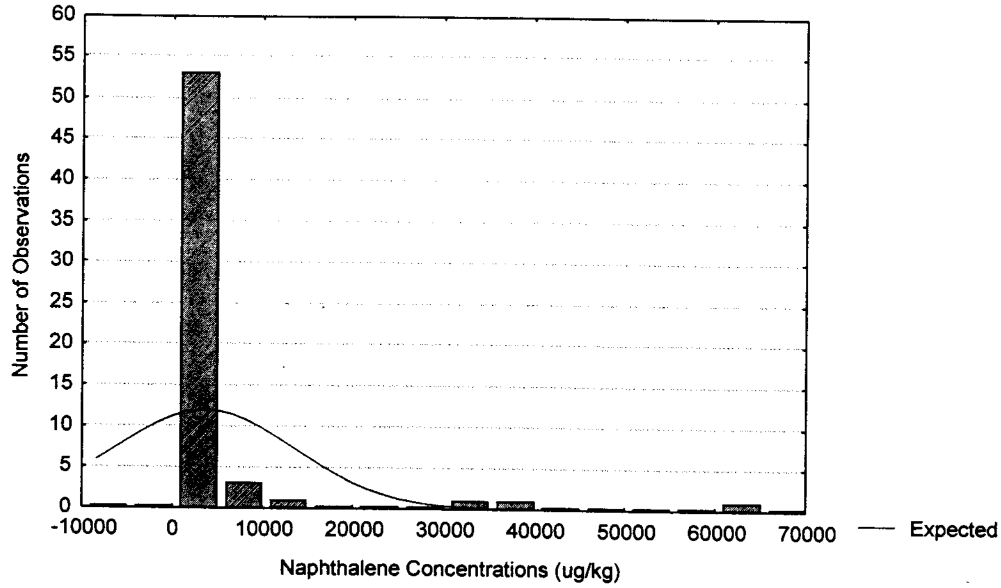


Figure 6
Fit-Test Distribution Histogram: Assumed Lognormal

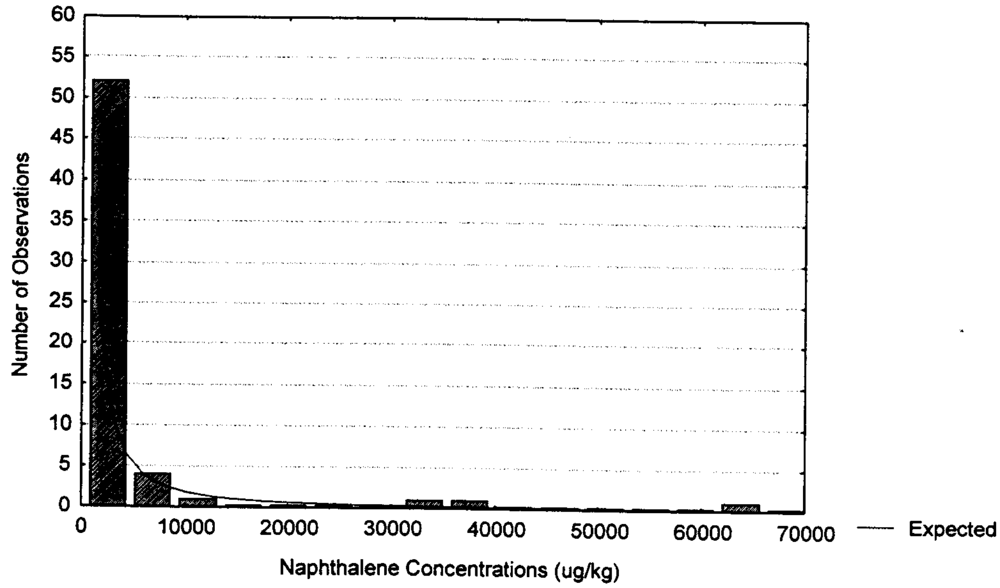


Figure 7
Fit-Test Distribution Histogram: Assumed Normal

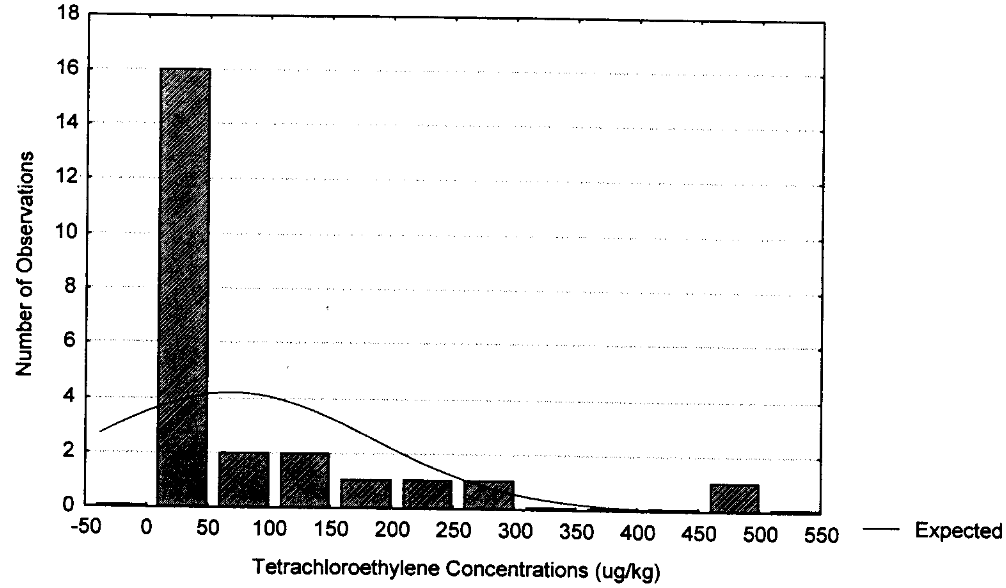


Figure 8
Fit-Test Distribution Histogram: Assumed Lognormal

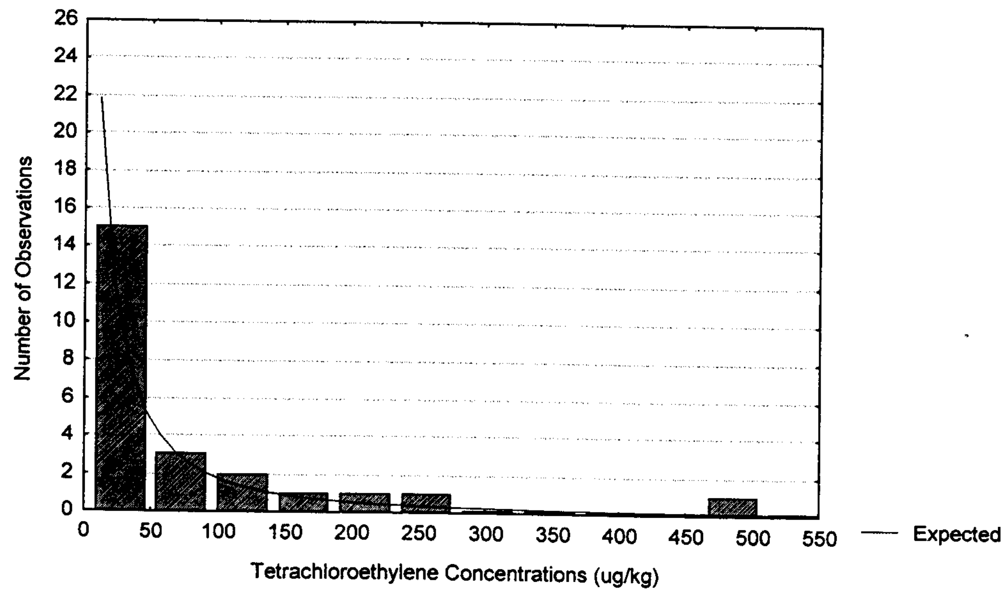


Figure 9
Fit-Test Distribution Histogram: Assumed Normal

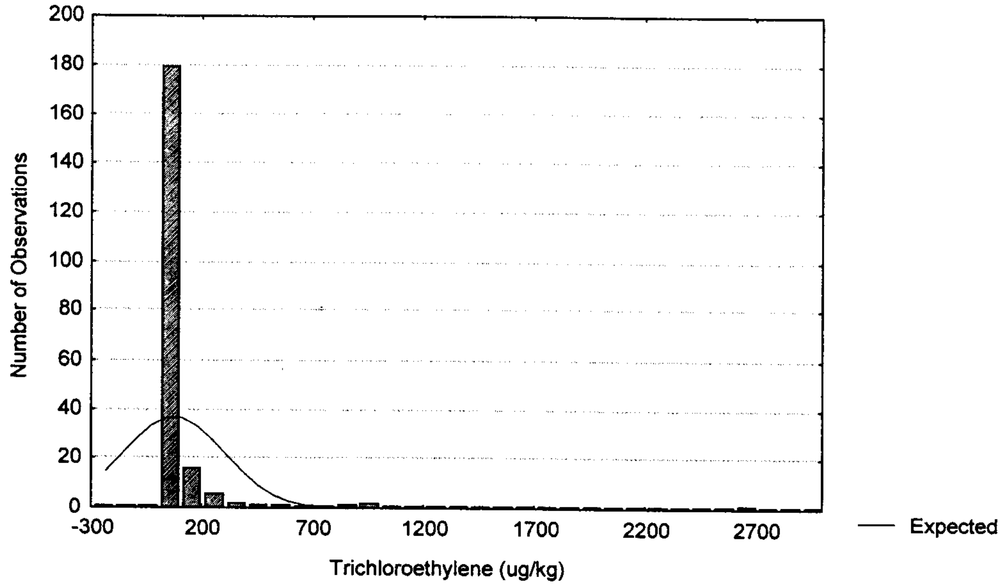


Figure 10
Fit-Test Distribution Histogram: Assumed Lognormal

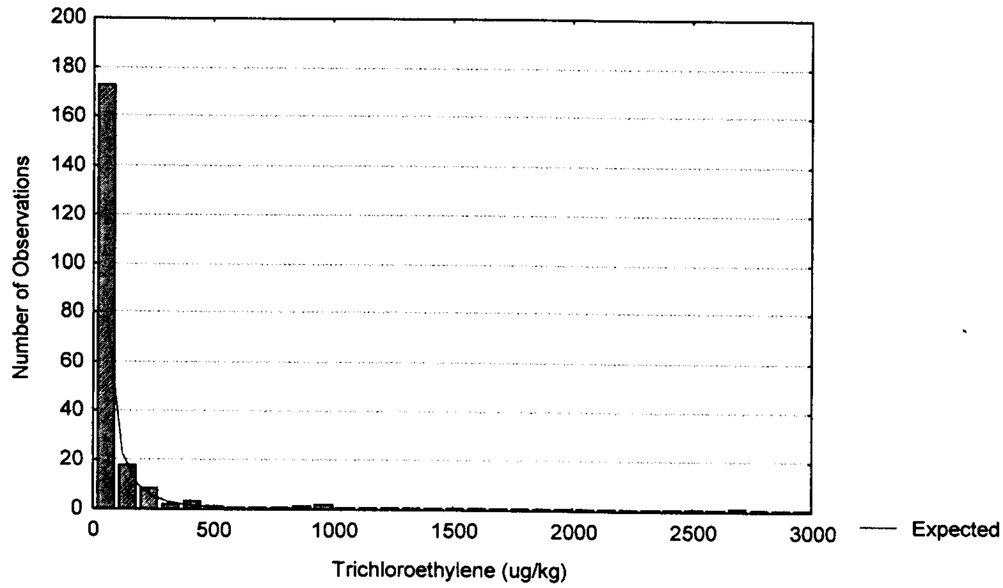


Figure 11
Fit-Test Distribution Histogram: Assumed Normal

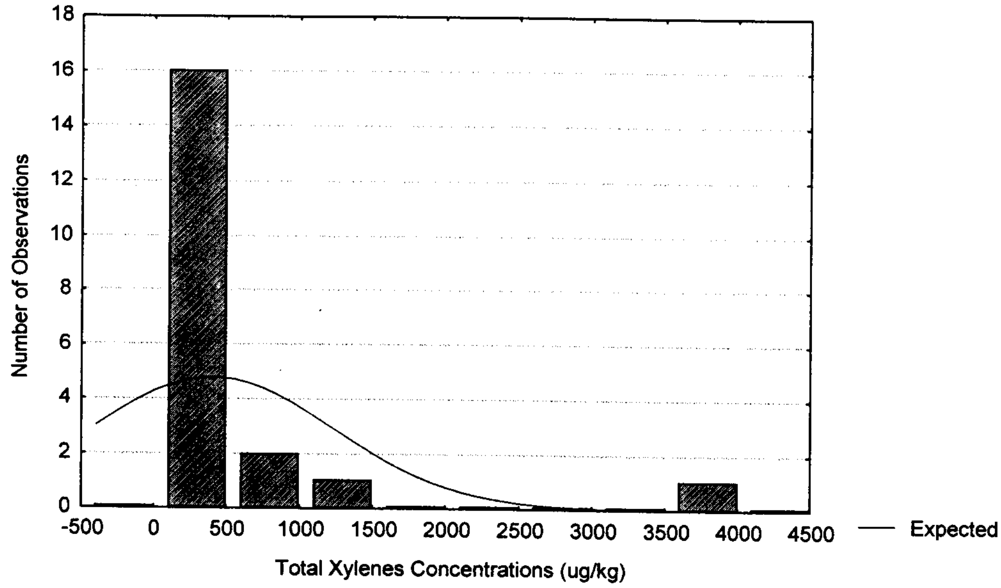


Figure 12
Fit-Test Distribution Histogram: Assumed Lognormal

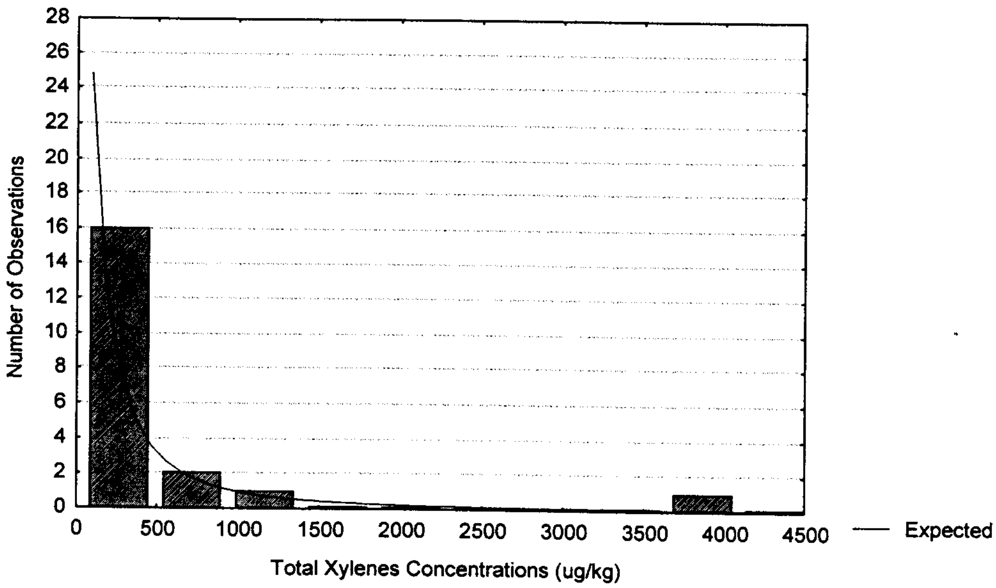


Figure 13
Fit-Test Distribution Histogram: Assumed Normal

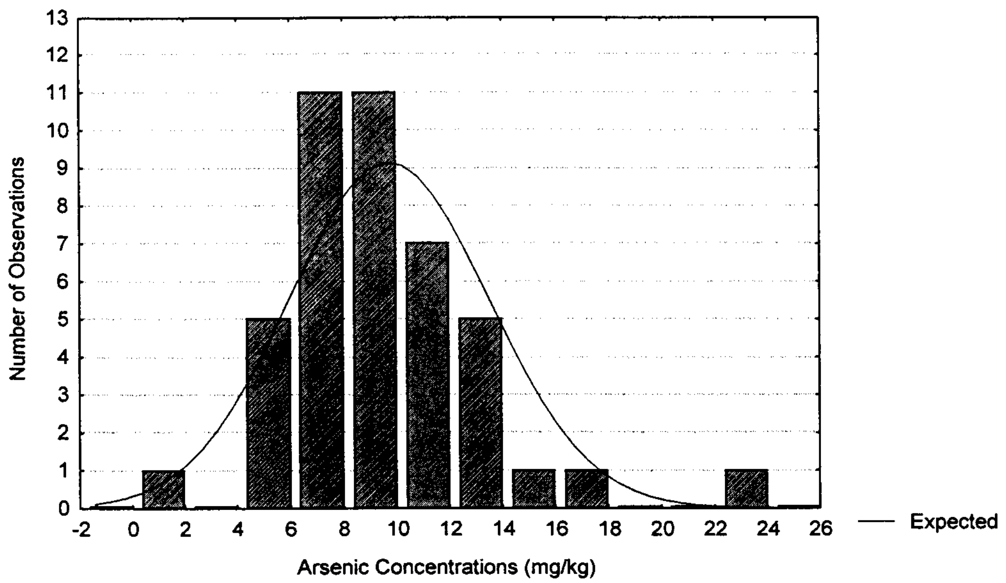
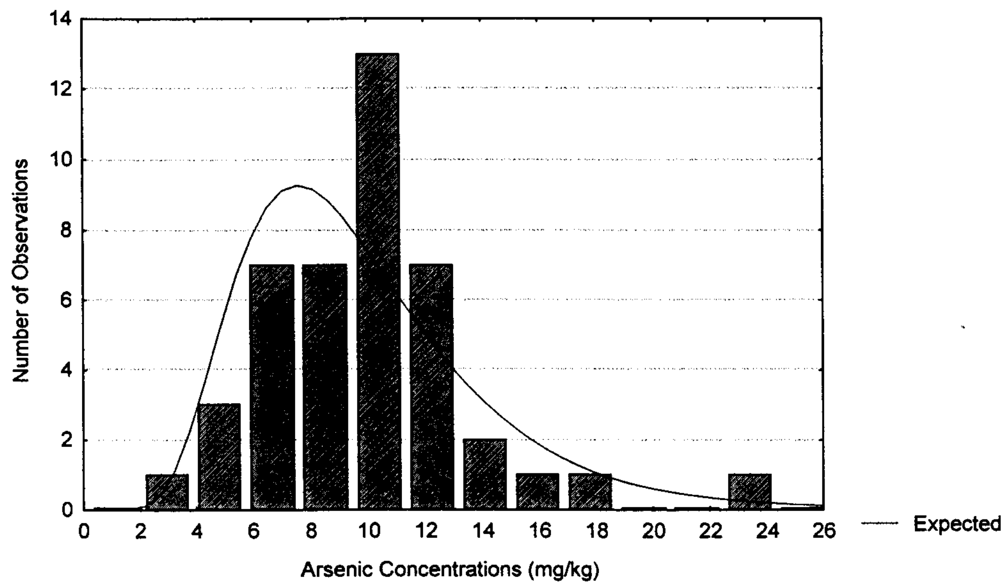


Figure 14
Fit-Test Distribution Histogram: Assumed Lognormal



b) the D'Agostino's test results to show either the normal or log-normal distribution.

The D'Agostino's test results were inconclusive and were supplemented with distribution histograms for the determination of data distributions. As noted in DTSC HERD's final policy titled *Selecting Inorganic Constituents as Chemicals of Potential Concern at Risk Assessments at Hazardous Waste Sites and Permitted Facilities* (Cal/EPA 1997), "distributions will generally fail tests for both normality and lognormality if they contain either multiple populations or a high proportion of non-detects." As presented in Table 2-1 of the PDRA, no organic constituents were detected in more than 16 percent of the samples. Thus the majority (>84 percent) of the samples analyzed for organic constituents were non-detects. This localized distribution of organics, with large areas of non-detects is indicative of a lognormal distribution and limited releases to the environmental media. This is consistent with the distribution used in the quantification of risk in the PDRA.

Comment 2: *Please use site-specific soil physical data (soil bulk density = 1.87 g/cm^3, water filled porosity = 0.37(-), and air filled porosity 0.06 (-)) to recalculate equations (5-1), (5-5), (5-11) and (5-12) for COPC tetrachloroethylene (Koc = 660 mL/g and H=0.957(-)), and tabulate the results in comparison with the current results in the report.*

Response: As presented in the subject document and communications between Integrated and RWQCB staff, DTSC-HERD default soil parameters were used to conservatively estimate the rate of emissions from the site soils. Based on the use of these more conservative parameters, this approach ensures that the emissions estimated for the site are not underestimated. The following table has been assembled for the requested comparison with the resultant conservative value highlighted in green:

Equation of Interest	Site-Specific Soil Parameters	PDRA Soil Parameters
(5-1) - Volatilization Factor (m^3/kg)	1.06E+04	3.02E+02
(5-5) - Soil-to-Air Partitioning Coefficient (g/cm^3)	3.60E-01	6.57E-01
(5-11) - Soil Gas Concentration (mg/L)	4.14E-06	7.51E-06
(5-12) - Vapor Flux (mg/cm^2-sec)	2.32E-12	7.32E-10

As shown in the comparison table, the values used in the PDRA are significantly more conservative then the site-specific data for the estimation of emissions. As mentioned in communications with Water Board staff, the most sensitive equations to the parameters identified by the RWQCB are 5-4 and 5-13, the calculation of the chemical-specific effective diffusivity (Dei). The Dei estimated in the PDRA represents a two orders of magnitude higher estimated diffusion rate through the soils.

I appreciate the opportunity to work closely with you and your staff on this important project. Should you or your staff have any further questions concerning the Post-Demolition Risk Assessment, please feel free to call me directly at (714) 852-9050, extension 20.

Sincerely,

Chris Stoker
Program Manager

CC: S. Mario Stavale, Boeing

- Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual, Part A (EPA 1989a)
- Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 1 (EPA 1989b)
- Statistical Methods for Environmental Pollution Monitoring (Gilbert 1987)
- Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities (EPA 1989c)

For each soil COPC, statistical summaries were developed, including the arithmetic mean, standard error of the arithmetic mean, minimum measured concentration, maximum measured concentration, frequency of detection, D'Agostino's test and histograms for distribution, fit testing, and 95 percent upper confidence limit (UCL) of the mean (see Appendices C and D). The applicability of D'Agostino's test and the 95 percent UCL of the mean is discussed below. First, however, an approach for the assignment of values for non-detected results is addressed.

5.2.1 Treatment of Non-Detected Constituents

Every analytical technique used to measure the concentration of constituents has an associated limit of detection (LOD) and limit of quantification (LOQ). A constituent that was not detected in a sample is below the LOD. A constituent that was detected but in such low amounts that its concentration could not be accurately determined is below the LOQ. When a constituent is reported as not detected in a sample, the actual concentration is any value up to the LOD.

For this post-demolition risk assessment, when a constituent was found in some of the samples and was not clearly spatially limited, it is assumed to exist in samples in which it was not detected. The assignment of a value of one-half the detection limit (if the constituent is normally distributed), or the detection limit divided by the square root of 2 (if the constituent is lognormally distributed), or the LOD to all samples reported as not detected reflects the assumption that the samples are equally likely to have any value up to the detection limit. Furthermore, when the sample values above the LOQ are lognormally distributed, it is.

reasonable to assume that values below the LOQ are also lognormally distributed, and the reported detection limit divided by the square root of 2 should be assigned as a proxy value (Cal/EPA 1992, EPA 1988a, 1988b).

5.2.2 Determination of Data Distribution

The data set distribution must be determined prior to the application of any statistical methods. This minimizes the effect of data biasing. D'Agostino's test (Gilbert 1987) is an effective method for testing whether a data set has been drawn from an underlying normal distribution (see Appendix D). Conducting the test on the logarithms of the data is an equally effective way of evaluating the hypothesis of a lognormal distribution. Distribution histograms were developed when D'Agostino's test was found to be inconclusive. The data sets for the post-demolition risk assessment were found to best fit the lognormal distribution and were statistically evaluated in this manner.

5.2.3 Use of 95 Percent Upper Confidence Limit Concentrations

Due to the uncertainty associated with characterizing potentially heterogeneous media, the 95 percent UCL for either a normal or lognormal distribution must be used to represent constituent concentrations (Cal/EPA 1992, EPA 1988a, 1988b). As previously mentioned, the Parcel A data were determined to be lognormally distributed. Thus, the upper 95 percent UCL for lognormal distribution was used for soil source-term concentrations (see Appendix D).

Tables 5-1 and 5-2 summarize the 95 percent UCL concentrations for the soil COPCs by AOPC as calculated for direct exposures (0 to 12 feet bgs) and long-term fate and transport modeling (0 to 50 feet bgs). It is important to note that when the 95 percent UCL exceeded the maximum detected value, the maximum detected value was used. This approach is consistent with DTSC guidance (Cal/EPA 1994).

The values presented in Tables 5-1 and 5-2 are used throughout the post-demolition risk assessment.

$$D_{ei} = D_i \times (P_a^{3.33}/P_t^2) \qquad (5\text{-}4)$$

where

D_i = COPC-specific diffusivity of COPC in air (cm^2/sec), from Table 5-3

P_a = air filled porosity of soil matrix, 0.284 (unitless) (Cal/EPA 1994)

P_t = total porosity of soil matrix, 0.434 (unitless) (Cal/EPA 1994)

The soil-to-air partition coefficient, K_{as}, was derived from the COPC-specific soil-water partition coefficient and Henry's Law constant:

$$K_{as} = H'/(R \times T \times K_d) \qquad (5\text{-}5)$$

where

H' = COPC-specific Henry's Law constant (atm-m^3/mol), from Table 5-3

R = ideal gas constant, 8.206×10^{-5} atm-m^3/mol/K

T = temperature in Kelvin, 293 K

K_d = soil-to-water partitioning coefficient (cm^3/g), K_{oc} from Table 5-3 times the fraction of organic carbon (foc), 0.004 (unitless)

The intermediate conversion factor, Z, in the volatilization attenuation factor was calculated as:

$$Z = (D_{ei} \times P_a)/[P_a + (ps \times (1-P_a)/K_{as})] \qquad (5\text{-}6)$$

where

D_{ei} = effective diffusivity of a COPC through a soil matrix (cm^2/sec)

P_a = air filled porosity of the soil matrix, 0.284 (unitless) (Cal/EPA 1994)

ps = true soil or particle density, 1.5 g/cm^3 (Cal/EPA 1994)

K_{as} = soil-to-air partition coefficient (g soil/cm^3 air)

A summary of the calculated volatilization attenuation factors is presented in Table 5-4. .

maximum off-site impact for each COPC. Additional discrete receptor points have been located along the northern boundary of the residential development to the south of the Boeing property. These receptors have been used to estimate maximum off-site residential exposure concentrations. The flagpole receptor option in the ISCST3 model was used to place the grid points 1.5 meters above the ground—the approximate breathing height of a typical adult.

TABLE 5-5
COPC FLUX RATES BY SOURCE (mg/cm^2 sec)

COPC	AOPC 1	AOPC 2
1,1-dichloroethene	3.51E-11	8.75E-11
1,2,4-trimethylbenzene	3.68E-14	1.83E-13
1,3,5-trimethylbenzene	1.07E-13	3.18E-13
aroclor 1248	NV	NV
aroclor 1254	NV	NV
aroclor 1260	NV	NV
arsenic	NV	NV
benzo(a)anthracene	NV	NV
benzo(a)pyrene	NV	NV
benzo(b)fluoranthene	NV	NV
benzo(k)fluoranthene	NV	NV
bis(2-ethylhexyl)phthalate	NV	NV
chrysene	NV	NV
dibenzo(a,h)anthracene	NV	NV
fluoranthene	NV	NV
indeno(1,2,3-cd)pyrene	NV	NV
naphthalene	NV	NV
n-butylbenzene	4.77E-14	9.70E-14
n-propylbenzene	1.36E-13	3.12E-13
p-cymene	8.24E-15	1.80E-14
phenanthrene	NV	NV
pyrene	NV	NV
tetrachloroethylene	7.32E-13	1.06E-12
trichloroethene	8.74E-13	3.35E-12
xylenes	9.11E-14	1.91E-13

NV = Not Volatile

Air Dispersion Modeling Results

The ISCST3 results for the maximum on- and off-site COPC, concentrations in air are summarized in Table 5-6. The modeling output files are provided in Appendix A.

TABLE 5-6
MODELED MAXIMUM ON-SITE AND OFF-SITE COPC CONCENTRATIONS IN AIR (mg/m^3)

COPC	Maximum On-Site Concentration	Maximum Off-Site Concentration	Maximum Residential Concentration
1,1-dichloroethene	1.24E-05	6.57E-06	3.65E-08
1,2,4-trimethylbenzene	2.38E-08	7.04E-09	3.83E-11
1,3,5-trimethylbenzene	4.37E-08	2.01E-08	1.11E-10
aroclor 1248	NV	NV	NV
aroclor 1254	NV	NV	NV
aroclor 1260	NV	NV	NV
arsenic	NV	NV	NV
benzo(a)anthracene	NV	NV	NV
benzo(a)pyrene	NV	NV	NV
benzo(b)fluoranthene	NV	NV	NV
benzo(k)fluoranthene	NV	NV	NV
bis(2-ethylhexyl)phthalate	NV	NV	NV
chrysene	NV	NV	NV
dibenzo(a,h)anthracene	NV	NV	NV
fluoranthene	NV	NV	NV
indeno(1,2,3-cd)pyrene	NV	NV	NV
naphthalene	NV	NV	NV
n-butylbenzene	1.43E-08	8.90E-09	4.96E-11
n-propylbenzene	4.48E-08	2.54E-08	1.41E-10
p-cymene	2.61E-09	1.54E-09	8.57E-12
phenanthrene	NV	NV	NV
pyrene	NV	NV	NV
tetrachloroethylene	1.70E-07	1.36E-07	7.61E-10
trichloroethene	4.46E-07	1.66E-07	9.09E-10
xylenes	2.79E-08	1.70E-08	9.47E-11

NV = Not Volatile

The exposure pathways of concern for the construction worker are: 1) inhalation of VOCs and particulate, 2) incidental ingestion of soil, and 3) dermal contact with soil. The example calculation methodology applies to all receptors associated with the Parcel A exposure scenarios; however, appropriate exposure parameters for other receptors would be substituted where applicable.

6.1.1 Air Exposures - Inhalation

Equation 6-16 from RAGS (EPA 1989a) was used to quantify intake from the inhalation pathway:

$$I_a = (C_a)(IR)(ET)(EF)(ED) / (BW)(AT) \tag{6-1}$$

where

I_a = intake from inhalation of a COPC in air (mg/kg-d)
C_a = concentration of COPC in air (mg/m^3)
IR = inhalation rate (m^3/h)
ET = exposure time (h/d)
EF = exposure frequency (d/y)
ED = exposure duration (y)
BW = body weight (kg)
AT = averaging time (d), ED x 365d/y (noncarcinogens), 70y x 365d/y (carcinogens)

The COPC concentration in air, C_a, was calculated separately for the construction and commercial/industrial emissions cases, as follows:

Construction Emissions Case

$$C_a = (C_s)(1/VF + 1/PF) \tag{6-2}$$

C_s = concentration of COPC in soil (mg/kg), from Table 5-1
VF = volatilization factor (m^3/kg), from Table 5-4

PF = particulate attenuation factor, 4.77×10^9 $\underline{\underline{m^3/kg}}$

Commercial/Industrial Emissions Case

$$C_a = C_i + C_o \qquad (6\text{-}3)$$

C_i = modeled indoor air concentration (mg/m^3), from Table 5-7

C_o = maximum modeled on-site COPC concentration (mg/m^3), from Table 5-6

As mentioned, the on-site construction worker's exposure to benzene is used as an example. The construction worker's intake (I_a) resulting from inhaling air hypothetically containing 1 milligram benzene per cubic meter air (C_a) is calculated as follows (see Table 6-1 for exposure parameters and sources). The inhalation rate (IR) for an active adult is 2.5 cubic meters per hour. The total exposure time (ET) is 8 hours per day for on-site exposures. The exposure duration (ED) is 1 year, and the exposure frequency (EF) is 250 days per year. The body weight (BW) for the adult resident is 70 kilograms. Since benzene is a carcinogen, the exposure is averaged over a 70-year lifetime (AT = 25,550 d). The exposure would be averaged over the period of exposure for all noncarcinogenic exposures (AT = ED x 365). Substituting these values into Equation 6-1 yields:

$$I_a = (1.0\ mg/m^3)(2.5\ m^3/h)(8\ h/d)(250\ d/y)(1\ y)\ /\ (70kg)(25550\ d) \qquad (6\text{-}4)$$

or

$$I_a = 2.80 \times 10^{-3}\ mg/kg\text{-}d$$

Appendix B presents the complete calculation sheets for inhalation exposures.

1.1.1 Soil Exposures - Incidental Ingestion

Equation 6-14 from RAGS (EPA 1989a) was used to quantify intake from the ingestion pathway:

6.3 RISKS POSED BY THE POST-DEMOLITION EXPOSURE SCENARIOS

Table 6-3 presents the total HI and total ILCR results for each AOPC and receptor studied under the Parcel A post-demolition exposure scenarios. Because the reasonable maximum exposure (RME) approach was used to quantify potential health impacts, it should be noted that if the estimated health effects of the RME are within acceptable limits, then it is likely that all other, lesser exposures related to Parcel A are also within these limits. See Section 4.1.3 for more information on RME.

Each entry in the Table 6-3 is supported by detailed calculations of health effects by receptor, COPC, and pathway (see Appendix B).

TABLE 6-3
SUMMARY OF POST-DEMOLITION HEALTH RISK, C-6 FACILITY, PARCEL A

On-Site Receptors	HI	ILCR
AOPC 1		
Construction Worker	5.1E-02	1.4E-06
Commercial/Industrial Worker, RME[a]	6.4E-05	1.2E-10
Commercial/Industrial Worker, Upper Bound[b]	4.6E-03	4.4E-06
AOPC 2		
Construction Worker	1.5E-02	7.7E-07
Commercial/Industrial Worker, RME[a]	8.7E-05	1.7E-10
Commercial/Industrial Worker, Upper Bound[b]	1.0E-03	2.5E-06
Off-Site Receptors	**HI**	**ILCR**
Commercial/Industrial Worker	2.5E-05	5.2E-11
Resident Adult	1.2E-06	2.9E-12
Resident Child	5.5E-06	2.7E-12

NOTES:
[a]Reasonable Maximum Exposure conditions, assumes 2-foot layer of clean fill.
[b]Upper Bound exposure conditions, assumes no layer of fill.

AOPC = Area of Potential Concern
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk

TABLE 8-1
SUMMARY OF POST-DEMOLITION HEALTH RISK,
C-6 FACILITY, PARCEL A

On-Site Receptors	HI	ILCR
AOPC 1		
Construction Worker	5.1E-02	1.4E-06
Commercial/Industrial Worker, RME[a]	6.4E-05	1.2E-10
Commercial/Industrial Worker, Upper Bound[b]	4.6E-03	4.4E-06
AOPC 2		
Construction Worker	1.5E-02	7.7E-07
Commercial/Industrial Worker, RME[a]	8.7E-05	1.7E-10
Commercial/Industrial Worker, Upper Bound[b]	1.0E-03	2.5E-06
Off-Site Receptors	**HI**	**ILCR**
Commercial/Industrial Worker	2.5E-05	5.2E-11
Resident Adult	1.2E-06	2.9E-12
Resident Child	5.5E-06	2.7E-12

[a]Reasonable Maximum Exposure conditions, assumes 2-foot layer of clean fill.
[b]Upper Bound exposure conditions, assumes no layer of fill.
AOPC = Area of Potential Concern
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk

Table B-1
Summary of Potential Health Effects
On-Site Construction Worker AOPC 1

Exposure Pathway	**Receptor Hazard Quotient**
Inhalation of Particulates and Volatiles	3.5E-03
Incidental ingestion of soils	3.1E-02
Dermal contact with soils	1.7E-02
Total Population Hazard Quotient =	5.1E-02

Exposure Pathway	**Receptor Incremental Lifetime Cancer Risk**
Inhalation of Particulates and Volatiles	8.1E-10
Incidental ingestion of soils	6.0E-07
Dermal contact with soils	8.2E-07
Total Population Incremental Lifetime Cancer Risk =	1.4E-06

Table B-2
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Incidental Ingestion of Soils

Intake Equation = $\frac{CS \times EF \times ED \times CF \times IR}{BW \times AT}$

IRs	Ingestion rate of soil (RAGS, 1989)	480	mg/day
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	250	d/year
EDn	Exposure duration for non-carcinogens	1	year
EDc	Exposure duration for carcinogens	1	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	365	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	Concentration
1,1-dichloroethene	2.57E-03
1,2,4-trimethylbenzene	3.82E-03
1,3,5-trimethylbenzene	2.96E-03
aroclor 1248	3.69E-02
aroclor 1254	3.28E-02
aroclor 1260	2.08E-02
arsenic	1.56E+00
benzo(a)anthracene	2.43E-01
benzo(a)pyrene	3.39E-01
benzo(b)fluoranthene	3.91E-01
benzo(k)fluoranthene	3.06E-01
bis(2-ethylhexyl)phthalate	2.58E-01
chrysene	2.86E-01
dibenzo(a,h)anthracene	1.36E-01
fluoranthene	2.66E-01
indeno(1,2,3-cd)pyrene	3.33E-01

Compound	Concentration
naphthalene	2.05E-01
n-butylbenzene	2.81E-03
n-propylbenzene	2.57E-03
p-cymene	2.47E-03
phenanthrene	2.03E-01
pyrene	3.12E-01
tetrachloroethene	2.69E-03
trichloroethene	2.63E-03
xylenes	2.34E-03

Table B-2 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Incidental Ingestion of Soils

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	1.21E-08	9.00E-03	1.34E-06
1,2,4-trimethylbenzene	1.79E-08	5.00E-01	3.59E-08
1,3,5-trimethylbenzene	1.39E-08	5.00E-01	2.78E-08
aroclor 1248	1.73E-07	7.00E-05	2.48E-03
aroclor 1254	1.54E-07	7.00E-05	2.20E-03
aroclor 1260	9.77E-08	7.00E-05	1.40E-03
arsenic	7.33E-06	3.00E-04	2.44E-02
benzo(a)anthracene	1.14E-06	4.00E-02	2.85E-05
benzo(a)pyrene	1.59E-06	4.00E-02	3.98E-05
benzo(b)fluoranthene	1.84E-06	4.00E-02	4.59E-05
benzo(k)fluoranthene	1.44E-06	4.00E-02	3.59E-05
bis(2-ethylhexyl)phthalate	1.21E-06	2.00E-02	6.06E-05
chrysene	1.34E-06	4.00E-02	3.36E-05
dibenzo(a,h)anthracene	6.39E-07	4.00E-02	1.60E-05
fluoranthene	1.25E-06	4.00E-01	3.12E-06
indeno(1,2,3-cd)pyrene	1.56E-06	4.00E-02	3.91E-05
naphthalene	9.63E-07	4.00E-02	2.41E-05
n-butylbenzene	1.32E-08	1.00E-01	1.32E-07
n-propylbenzene	1.21E-08	1.00E-01	1.21E-07
p-cymene	1.16E-08	1.00E-01	1.16E-07
phenanthrene	9.53E-07	3.00E-01	3.18E-06
pyrene	1.47E-06	3.00E-01	4.88E-06
tetrachloroethene	1.26E-08	1.00E-01	1.26E-07
trichloroethene	1.24E-08	7.35E-03	1.68E-06
xylenes	1.10E-08	2.00E+00	5.50E-09
	HQ Summation =		3.1E-02

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	1.72E-10	NA	NA
1,2,4-trimethylbenzene	2.56E-10	NA	NA
1,3,5-trimethylbenzene	1.99E-10	NA	NA
aroclor 1248	2.48E-09	7.70E+00	1.91E-08
aroclor 1254	2.20E-09	7.70E+00	1.69E-08
aroclor 1260	1.40E-09	7.70E+00	1.07E-08
arsenic	1.05E-07	1.50E+00	1.57E-07
benzo(a)anthracene	1.63E-08	1.15E+00	1.87E-08
benzo(a)pyrene	2.27E-08	1.15E+01	2.62E-07
benzo(b)fluoranthene	2.62E-08	1.15E+00	3.02E-08
benzo(k)fluoranthene	2.05E-08	1.15E+00	2.36E-08
bis(2-ethylhexyl)phthalate	1.73E-08	8.40E-03	1.45E-10
chrysene	1.92E-08	1.15E-01	2.21E-09
dibenzo(a,h)anthracene	9.12E-09	4.10E+00	3.74E-08
fluoranthene	1.78E-08	NA	NA
indeno(1,2,3-cd)pyrene	2.23E-08	1.15E+00	2.57E-08
naphthalene	1.38E-08	NA	NA
n-butylbenzene	1.89E-10	NA	NA
n-propylbenzene	1.72E-10	NA	NA
p-cymene	1.66E-10	NA	NA
phenanthrene	1.36E-08	NA	NA
pyrene	2.09E-08	NA	NA
tetrachloroethene	1.80E-10	5.10E-02	9.20E-12
trichloroethene	1.76E-10	1.50E-02	2.65E-12
xylenes	1.57E-10	NA	NA
	ILCR Summation =		6.0E-07

Table B-3
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Dermal Contact with Soils

Intake Equation = $\frac{CS \times CF \times EF \times ED \times AF \times ABS \times SA}{BW \times AT}$

SA	Surface area of exposed skin (50th percentile, hands only)	5800	cm^2/day
AF	Adherence Factor	1	mg/cm^2
ABS	Absorption factor (see table below)	csv	
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	250	d/year
EDn	Exposure duration for non-carcinogens	1	year
EDc	Exposure duration for carcinogens	1	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	365	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	ABS (unitless)	Concentration (mg/kg)
1,1-dichloroethene	1.00E-01	2.57E-03
1,2,4-trimethylbenzene	1.00E-01	3.82E-03
1,3,5-trimethylbenzene	1.00E-01	2.96E-03
aroclor 1248	1.00E-01	3.69E-02
aroclor 1254	1.00E-01	3.28E-02
aroclor 1260	1.00E-01	2.08E-02
arsenic	3.00E-02	1.56E+00
benzo(a)anthracene	1.50E-01	2.43E-01
benzo(a)pyrene	1.50E-01	3.39E-01
benzo(b)fluoranthene	1.50E-01	3.91E-01
benzo(k)fluoranthene	1.50E-01	3.06E-01
bis(2-ethylhexyl)phthalate	1.00E-01	2.58E-01
chrysene	1.50E-01	2.86E-01
dibenzo(a,h)anthracene	1.50E-01	1.36E-01
fluoranthene	1.00E-01	2.66E-01
indeno(1,2,3-cd)pyrene	1.00E-01	3.33E-01

Compound	ABS (unitless)	Concentration (mg/kg)
naphthalene	1.50E-01	2.05E-01
n-butylbenzene	1.00E-01	2.81E-03
n-propylbenzene	1.00E-01	2.57E-03
p-cymene	1.00E-01	2.47E-03
phenanthrene	1.50E-01	2.03E-01
pyrene	1.50E-01	3.12E-01
tetrachloroethene	1.00E-01	2.69E-03
trichloroethene	1.00E-01	2.63E-03
xylenes	1.00E-01	2.34E-03

Table B-3 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Dermal Contact with Soils

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	1.46E-08	9.00E-03	1.62E-06
1,2,4-trimethylbenzene	2.17E-08	5.00E-01	4.34E-08
1,3,5-trimethylbenzene	1.68E-08	5.00E-01	3.36E-08
aroclor 1248	2.09E-07	7.00E-05	2.99E-03
aroclor 1254	1.86E-07	7.00E-05	2.66E-03
aroclor 1260	1.18E-07	7.00E-05	1.69E-03
arsenic	2.66E-06	3.00E-04	8.85E-03
benzo(a)anthracene	2.07E-06	4.00E-02	5.17E-05
benzo(a)pyrene	2.89E-06	4.00E-02	7.21E-05
benzo(b)fluoranthene	3.33E-06	4.00E-02	8.32E-05
benzo(k)fluoranthene	2.60E-06	4.00E-02	6.51E-05
bis(2-ethylhexyl)phthalate	1.46E-06	2.00E-02	7.32E-05
chrysene	2.43E-06	4.00E-02	6.09E-05
dibenzo(a,h)anthracene	1.16E-06	4.00E-02	2.89E-05
fluoranthene	1.51E-06	4.00E-01	3.77E-06
indeno(1,2,3-cd)pyrene	1.89E-06	4.00E-02	4.72E-05
naphthalene	1.75E-06	4.00E-02	4.36E-05
n-butylbenzene	1.59E-08	1.00E-01	1.59E-07
n-propylbenzene	1.46E-08	1.00E-01	1.46E-07
p-cymene	1.40E-08	1.00E-01	1.40E-07
phenanthrene	1.73E-06	3.00E-01	5.76E-06
pyrene	2.66E-06	3.00E-01	8.85E-06
tetrachloroethene	1.53E-08	1.00E-01	1.53E-07
trichloroethene	1.49E-08	7.35E-03	2.03E-06
xylenes	1.33E-08	2.00E+00	6.64E-09
	HQ Summation =		1.7E-02

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	2.08E-10	NA	NA
1,2,4-trimethylbenzene	3.10E-10	NA	NA
1,3,5-trimethylbenzene	2.40E-10	NA	NA
aroclor 1248	2.99E-09	7.70E+00	2.30E-08
aroclor 1254	2.66E-09	7.70E+00	2.05E-08
aroclor 1260	1.69E-09	7.70E+00	1.30E-08
arsenic	3.79E-08	1.50E+00	5.69E-08
benzo(a)anthracene	2.96E-08	1.15E+00	3.40E-08
benzo(a)pyrene	4.12E-08	1.15E+01	4.74E-07
benzo(b)fluoranthene	4.75E-08	1.15E+00	5.47E-08
benzo(k)fluoranthene	3.72E-08	1.15E+00	4.28E-08
bis(2-ethylhexyl)phthalate	2.09E-08	8.40E-03	1.76E-10
chrysene	3.48E-08	1.15E-01	4.00E-09
dibenzo(a,h)anthracene	1.65E-08	4.10E+00	6.78E-08
fluoranthene	2.16E-08	NA	NA
indeno(1,2,3-cd)pyrene	2.70E-08	1.15E+00	3.10E-08
naphthalene	2.49E-08	NA	NA
n-butylbenzene	2.28E-10	NA	NA
n-propylbenzene	2.08E-10	NA	NA
p-cymene	2.00E-10	NA	NA
phenanthrene	2.47E-08	NA	NA
pyrene	3.79E-08	NA	NA
tetrachloroethene	2.18E-10	5.10E-02	1.11E-11
trichloroethene	2.13E-10	1.50E-02	3.20E-12
xylenes	1.90E-10	NA	NA
	ILCR Summation =		8.2E-07

Table B-4
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Inhalation of Particulates and Volatiles

Intake Equation = $\frac{CS \times (1/VF + 1/PEF) \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	2.5 m3/h
EF	Exposure frequency	250 days/year
EDn	Exposure duration for non-carcinogens	1 year
EDc	Exposure duration for carcinogens	1 year
BW	Body weight	70 kg
ATc	Average time for carcinogens (lifetime)	25550 days
ATn	Average time for non-carcinogens (EDn x 365)	365 days
ET	Exposure tim outdoors	8 h/d
CS	Concentration of chemicals in soil	(see Table 5-1)
VF	Volatilization Factor	(see Table 5-4)
PEF	Particulate Emission Factor	(see Section 5.3.1.2)

Chemical Concentrations

Compound	VF (m3/kg)	PEF (m3/kg)	Cs (mg/kg)
1,1-dichloroethene	2.07E+01	NA	2.57E-03
1,2,4-trimethylbenzene	1.79E+03	NA	3.82E-03
1,3,5-trimethylbenzene	8.99E+02	NA	2.96E-03
aroclor 1248	NA	4.77E+09	3.69E-02
aroclor 1254	NA	4.77E+09	3.28E-02
aroclor 1260	NA	4.77E+09	2.08E-02
arsenic	NA	4.77E+09	1.56E+00
benzo(a)anthracene	NA	4.77E+09	2.43E-01
benzo(a)pyrene	NA	4.77E+09	3.39E-01
benzo(b)fluoranthene	NA	4.77E+09	3.91E-01
benzo(k)fluoranthene	NA	4.77E+09	3.06E-01
bis(2-ethylhexyl)phthalate	NA	4.77E+09	2.58E-01
chrysene	NA	4.77E+09	2.86E-01
dibenzo(a,h)anthracene	NA	4.77E+09	1.36E-01
fluoranthene	NA	4.77E+09	2.66E-01
indeno(1,2,3-cd)pyrene	NA	4.77E+09	3.33E-01

Compound	VF (m3/kg)	PEF (m3/kg)	Cs (mg/kg)
naphthalene	NA	4.77E+09	2.05E-01
n-butylbenzene	1.26E+03	NA	2.81E-03
n-propylbenzene	7.29E+02	NA	2.57E-03
p-cymene	2.94E+03	NA	2.47E-03
phenanthrene	NA	4.77E+09	2.03E-01
pyrene	NA	4.77E+09	3.12E-01
tetrachloroethene	3.02E+02	NA	2.69E-03
trichloroethene	2.72E+02	NA	2.63E-03
xylenes	8.50E+02	NA	2.34E-03

Table B-4 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Inhalation of Particulates and Volatiles

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.43E-05	9.00E-03	2.70E-03
1,2,4-trimethylbenzene	4.18E-07	2.00E-03	2.09E-04
1,3,5-trimethylbenzene	6.44E-07	2.00E-03	3.22E-04
aroclor 1248	1.51E-12	7.00E-05	2.16E-08
aroclor 1254	1.34E-12	7.00E-05	1.92E-08
aroclor 1260	8.53E-13	7.00E-05	1.22E-08
arsenic	6.39E-11	3.00E-04	2.13E-07
benzo(a)anthracene	9.96E-12	4.00E-02	2.49E-10
benzo(a)pyrene	1.39E-11	4.00E-02	3.47E-10
benzo(b)fluoranthene	1.60E-11	4.00E-02	4.01E-10
benzo(k)fluoranthene	1.25E-11	4.00E-02	3.14E-10
bis(2-ethylhexyl)phthalate	1.06E-11	2.00E-02	5.29E-10
chrysene	1.17E-11	4.00E-02	2.93E-10
dibenzo(a,h)anthracene	5.57E-12	4.00E-02	1.39E-10
fluoranthene	1.09E-11	4.00E-01	2.73E-11
indeno(1,2,3-cd)pyrene	1.36E-11	4.00E-02	3.41E-10
naphthalene	8.40E-12	4.00E-02	2.10E-10
n-butylbenzene	4.38E-07	2.90E-01	1.51E-06
n-propylbenzene	6.90E-07	2.90E-01	2.38E-06
p-cymene	1.64E-07	1.00E-01	1.64E-06
phenanthrene	8.32E-12	3.00E-01	2.77E-11
pyrene	1.28E-11	3.00E-01	4.26E-11
tetrachloroethene	1.74E-06	1.00E-01	1.74E-05
trichloroethene	1.89E-06	7.35E-03	2.58E-04
xylenes	5.39E-07	2.00E-01	2.69E-06
	HQ Summation =		3.5E-03

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	3.47E-07	NA	NA
1,2,4-trimethylbenzene	5.97E-09	NA	NA
1,3,5-trimethylbenzene	9.21E-09	NA	NA
aroclor 1248	2.16E-14	7.70E+00	1.66E-13
aroclor 1254	1.92E-14	7.70E+00	1.48E-13
aroclor 1260	1.22E-14	7.70E+00	9.38E-14
arsenic	9.13E-13	1.20E+01	1.10E-11
benzo(a)anthracene	1.42E-13	3.90E-01	5.55E-14
benzo(a)pyrene	1.99E-13	3.90E+00	7.74E-13
benzo(b)fluoranthene	2.29E-13	3.90E-01	8.93E-14
benzo(k)fluoranthene	1.79E-13	3.90E-01	6.99E-14
bis(2-ethylhexyl)phthalate	1.51E-13	8.40E-03	1.27E-15
chrysene	1.67E-13	3.90E-02	6.53E-15
dibenzo(a,h)anthracene	7.96E-14	4.10E+00	3.27E-13
fluoranthene	1.56E-13	NA	NA
indeno(1,2,3-cd)pyrene	1.95E-13	3.90E-01	7.60E-14
naphthalene	1.20E-13	NA	NA
n-butylbenzene	6.26E-09	NA	NA
n-propylbenzene	9.85E-09	NA	NA
p-cymene	2.35E-09	NA	NA
phenanthrene	1.19E-13	NA	NA
pyrene	1.83E-13	NA	NA
tetrachloroethene	2.49E-08	2.10E-02	5.22E-10
trichloroethene	2.71E-08	1.00E-02	2.71E-10
xylenes	7.70E-09	NA	NA
	ILCR Summation =		8.1E-10

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Table B-5
Summary of Potential Health Effects
On-Site Construction Worker AOPC 2

Exposure Pathway	**Receptor Hazard Quotient**
Inhalation of Particulates and Volatiles	7.1E-03
Incidental ingestion of soils	3.5E-03
Dermal contact with soils	4.4E-03
Total Population Hazard Quotient =	1.5E-02

Exposure Pathway	**Receptor Incremental Lifetime Cancer Risk**
Inhalation of Particulates and Volatiles	1.8E-09
Incidental ingestion of soils	2.8E-07
Dermal contact with soils	4.8E-07
Total Population Incremental Lifetime Cancer Risk =	7.7E-07

Table B-6
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Incidental Ingestion of Soils

Intake Equation = $\frac{CS \times EF \times ED \times CF \times IR}{BW \times AT}$

IRs	Ingestion rate of soil (RAGS, 1989)	480 mg/day
CF	Conversion factor	1.0E-06 kg/mg
EF	Exposure frequency	250 d/year
EDn	Exposure duration for non-carcinogens	1 year
EDc	Exposure duration for carcinogens	1 year
BW	Body weight	70 kg
ATc	Average time for carcinogens (lifetime)	25550 day
ATn	Average time for non-carcinogens (EDn x 365)	365 day
CS	Concentration of chemicals in soil	(see Table 5-1)

Chemical Concentrations

Compound	Concentration
1,1-dichloroethene	4.05E-03
1,2,4-trimethylbenzene	1.85E-02
1,3,5-trimethylbenzene	8.93E-03
aroclor 1248	1.63E-02
aroclor 1254	1.63E-02
aroclor 1260	1.72E-02
arsenic	NA
benzo(a)anthracene	1.06E-01
benzo(a)pyrene	2.24E-01
benzo(b)fluoranthene	2.28E-01
benzo(k)fluoranthene	2.05E-01
bis(2-ethylhexyl)phthalate	1.03E-01
chrysene	1.22E-01
dibenzo(a,h)anthracene	8.54E-02
fluoranthene	1.18E-01
indeno(1,2,3-cd)pyrene	2.12E-01

Compound	Concentration
naphthalene	2.15E-01
n-butylbenzene	6.18E-03
n-propylbenzene	5.78E-03
p-cymene	6.45E-03
phenanthrene	1.42E-01
pyrene	1.28E-01
tetrachloroethene	4.53E-03
trichloroethene	8.56E-03
xylenes	6.45E-03

Table B-6 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Incidental Ingestion of Soils

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	1.90E-08	9.00E-03	2.11E-06
1,2,4-trimethylbenzene	8.69E-08	5.00E-01	1.74E-07
1,3,5-trimethylbenzene	4.19E-08	5.00E-01	8.39E-08
aroclor 1248	7.66E-08	7.00E-05	1.09E-03
aroclor 1254	7.66E-08	7.00E-05	1.09E-03
aroclor 1260	8.08E-08	7.00E-05	1.15E-03
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	4.98E-07	4.00E-02	1.24E-05
benzo(a)pyrene	1.05E-06	4.00E-02	2.63E-05
benzo(b)fluoranthene	1.07E-06	4.00E-02	2.68E-05
benzo(k)fluoranthene	9.63E-07	4.00E-02	2.41E-05
bis(2-ethylhexyl)phthalate	4.84E-07	2.00E-02	2.42E-05
chrysene	5.73E-07	4.00E-02	1.43E-05
dibenzo(a,h)anthracene	4.01E-07	4.00E-02	1.00E-05
fluoranthene	5.54E-07	4.00E-01	1.39E-06
indeno(1,2,3-cd)pyrene	9.96E-07	4.00E-02	2.49E-05
naphthalene	1.01E-06	4.00E-02	2.52E-05
n-butylbenzene	2.90E-08	1.00E-01	2.90E-07
n-propylbenzene	2.71E-08	1.00E-01	2.71E-07
p-cymene	3.03E-08	1.00E-01	3.03E-07
phenanthrene	6.67E-07	3.00E-01	2.22E-06
pyrene	6.01E-07	3.00E-01	2.00E-06
tetrachloroethene	2.13E-08	1.00E-01	2.13E-07
trichloroethene	4.02E-08	7.35E-03	5.47E-06
xylenes	3.03E-08	2.00E+00	1.51E-08
	HQ Summation =		3.5E-03

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	2.72E-10	NA	NA
1,2,4-trimethylbenzene	1.24E-09	NA	NA
1,3,5-trimethylbenzene	5.99E-10	NA	NA
aroclor 1248	1.09E-09	7.70E+00	8.42E-09
aroclor 1254	1.09E-09	7.70E+00	8.42E-09
aroclor 1260	1.15E-09	7.70E+00	8.89E-09
arsenic	NA	1.50E+00	NA
benzo(a)anthracene	7.11E-09	1.15E+00	8.18E-09
benzo(a)pyrene	1.50E-08	1.15E+01	1.73E-07
benzo(b)fluoranthene	1.53E-08	1.15E+00	1.76E-08
benzo(k)fluoranthene	1.38E-08	1.15E+00	1.58E-08
bis(2-ethylhexyl)phthalate	6.91E-09	8.40E-03	5.81E-11
chrysene	8.19E-09	1.15E-01	9.41E-10
dibenzo(a,h)anthracene	5.73E-09	4.10E+00	2.35E-08
fluoranthene	7.92E-09	NA	NA
indeno(1,2,3-cd)pyrene	1.42E-08	1.15E+00	1.64E-08
naphthalene	1.44E-08	NA	NA
n-butylbenzene	4.15E-10	NA	NA
n-propylbenzene	3.88E-10	NA	NA
p-cymene	4.33E-10	NA	NA
phenanthrene	9.53E-09	NA	NA
pyrene	8.59E-09	NA	NA
tetrachloroethene	3.04E-10	5.10E-02	1.55E-11
trichloroethene	5.74E-10	1.50E-02	8.62E-12
xylenes	4.33E-10	NA	NA
	ILCR Summation =		2.8E-07

Table B-7
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Dermal Contact with Soils

Intake Equation = $\frac{CS \times CF \times EF \times ED \times AF \times ABS \times SA}{BW \times AT}$

SA	Surface area of exposed skin (50th percentile, hands only)	5800 cm^2/day
AF	Adherence Factor	1 mg/cm^2
ABS	Absorption factor (see table below)	csv
CF	Conversion factor	1.0E-06 kg/mg
EF	Exposure frequency	250 d/year
EDn	Exposure duration for non-carcinogens	1 year
EDc	Exposure duration for carcinogens	1 year
BW	Body weight	70 kg
ATc	Average time for carcinogens (lifetime)	25550 day
ATn	Average time for non-carcinogens (EDn x 365)	365 day
CS	Concentration of chemicals in soil	(see Table 5-1)

Chemical Concentrations

Compound	ABS (unitless)	Concentration (mg/kg)
1,1-dichloroethene	1.00E-01	4.05E-03
1,2,4-trimethylbenzene	1.00E-01	1.85E-02
1,3,5-trimethylbenzene	1.00E-01	8.93E-03
aroclor 1248	1.00E-01	1.63E-02
aroclor 1254	1.00E-01	1.63E-02
aroclor 1260	1.00E-01	1.72E-02
arsenic	3.00E-02	NA
benzo(a)anthracene	1.50E-01	1.06E-01
benzo(a)pyrene	1.50E-01	2.24E-01
benzo(b)fluoranthene	1.50E-01	2.28E-01
benzo(k)fluoranthene	1.50E-01	2.05E-01
bis(2-ethylhexyl)phthalate	1.00E-01	1.03E-01
chrysene	1.50E-01	1.22E-01
dibenzo(a,h)anthracene	1.50E-01	8.54E-02
fluoranthene	1.00E-01	1.18E-01
indeno(1,2,3-cd)pyrene	1.00E-01	2.12E-01

Compound	ABS (unitless)	Concentration (mg/kg)
naphthalene	1.50E-01	2.15E-01
n-butylbenzene	1.00E-01	6.18E-03
n-propylbenzene	1.00E-01	5.78E-03
p-cymene	1.00E-01	6.45E-03
phenanthrene	1.50E-01	1.42E-01
pyrene	1.50E-01	1.28E-01
tetrachloroethene	1.00E-01	4.53E-03
trichloroethene	1.00E-01	8.56E-03
xylenes	1.00E-01	6.45E-03

Table B-7 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Dermal Contact with Soils

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.30E-08	9.00E-03	2.55E-06
1,2,4-trimethylbenzene	1.05E-07	5.00E-01	2.10E-07
1,3,5-trimethylbenzene	5.07E-08	5.00E-01	1.01E-07
aroclor 1248	9.25E-08	7.00E-05	1.32E-03
aroclor 1254	9.25E-08	7.00E-05	1.32E-03
aroclor 1260	9.76E-08	7.00E-05	1.39E-03
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	9.02E-07	4.00E-02	2.26E-05
benzo(a)pyrene	1.91E-06	4.00E-02	4.77E-05
benzo(b)fluoranthene	1.94E-06	4.00E-02	4.85E-05
benzo(k)fluoranthene	1.75E-06	4.00E-02	4.36E-05
bis(2-ethylhexyl)phthalate	5.85E-07	2.00E-02	2.92E-05
chrysene	1.04E-06	4.00E-02	2.60E-05
dibenzo(a,h)anthracene	7.27E-07	4.00E-02	1.82E-05
fluoranthene	6.70E-07	4.00E-01	1.67E-06
indeno(1,2,3-cd)pyrene	1.20E-06	4.00E-02	3.01E-05
naphthalene	1.83E-06	4.00E-02	4.58E-05
n-butylbenzene	3.51E-08	1.00E-01	3.51E-07
n-propylbenzene	3.28E-08	1.00E-01	3.28E-07
p-cymene	3.66E-08	1.00E-01	3.66E-07
phenanthrene	1.21E-06	3.00E-01	4.03E-06
pyrene	1.09E-06	3.00E-01	3.63E-06
tetrachloroethene	2.57E-08	1.00E-01	2.57E-07
trichloroethene	4.86E-08	7.35E-03	6.61E-06
xylenes	3.66E-08	2.00E+00	1.83E-08
	HQ Summation =		4.4E-03

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	3.28E-10	NA	NA
1,2,4-trimethylbenzene	1.50E-09	NA	NA
1,3,5-trimethylbenzene	7.24E-10	NA	NA
aroclor 1248	1.32E-09	7.70E+00	1.02E-08
aroclor 1254	1.32E-09	7.70E+00	1.02E-08
aroclor 1260	1.39E-09	7.70E+00	1.07E-08
arsenic	NA	1.50E+00	NA
benzo(a)anthracene	1.29E-08	1.15E+00	1.48E-08
benzo(a)pyrene	2.72E-08	1.15E+01	3.13E-07
benzo(b)fluoranthene	2.77E-08	1.15E+00	3.19E-08
benzo(k)fluoranthene	2.49E-08	1.15E+00	2.87E-08
bis(2-ethylhexyl)phthalate	8.35E-09	8.40E-03	7.01E-11
chrysene	1.48E-08	1.15E-01	1.71E-09
dibenzo(a,h)anthracene	1.04E-08	4.10E+00	4.26E-08
fluoranthene	9.57E-09	NA	NA
indeno(1,2,3-cd)pyrene	1.72E-08	1.15E+00	1.98E-08
naphthalene	2.61E-08	NA	NA
n-butylbenzene	5.01E-10	NA	NA
n-propylbenzene	4.69E-10	NA	NA
p-cymene	5.23E-10	NA	NA
phenanthrene	1.73E-08	NA	NA
pyrene	1.56E-08	NA	NA
tetrachloroethene	3.67E-10	5.10E-02	1.87E-11
trichloroethene	6.94E-10	1.50E-02	1.04E-11
xylenes	5.23E-10	NA	NA
	ILCR Summation =		4.8E-07

Table B-8
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Inhalation of Particulates and Volatiles

Intake Equation = $\frac{CS \times (1/VF + 1/PEF) \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	2.5 m3/h
EF	Exposure frequency	250 days/year
EDn	Exposure duration for non-carcinogens	1 year
EDc	Exposure duration for carcinogens	1 year
BW	Body weight	70 kg
ATc	Average time for carcinogens (lifetime)	25550 days
ATn	Average time for non-carcinogens (EDn x 365)	365 days
ET	Exposure tim outdoors	8 h/d
CS	Concentration of chemicals in soil	(see Table 5-1)
VF	Volatilization Factor	(see Table 5-4)
PEF	Particulate Emission Factor	(see Section 5.3.1.2)

Chemical Concentrations

Compound	VF (m3/kg)	PEF (m3/kg)	Cs (mg/kg)
1,1-dichloroethene	2.07E+01	NA	4.05E-03
1,2,4-trimethylbenzene	1.79E+03	NA	1.85E-02
1,3,5-trimethylbenzene	8.99E+02	NA	8.93E-03
aroclor 1248	NA	4.77E+09	1.63E-02
aroclor 1254	NA	4.77E+09	1.63E-02
aroclor 1260	NA	4.77E+09	1.72E-02
arsenic	NA	4.77E+09	NA
benzo(a)anthracene	NA	4.77E+09	1.06E-01
benzo(a)pyrene	NA	4.77E+09	2.24E-01
benzo(b)fluoranthene	NA	4.77E+09	2.28E-01
benzo(k)fluoranthene	NA	4.77E+09	2.05E-01
bis(2-ethylhexyl)phthalate	NA	4.77E+09	1.03E-01
chrysene	NA	4.77E+09	1.22E-01
dibenzo(a,h)anthracene	NA	4.77E+09	8.54E-02
fluoranthene	NA	4.77E+09	1.18E-01
indeno(1,2,3-cd)pyrene	NA	4.77E+09	2.12E-01

Compound	VF (m3/kg)	PEF (m3/kg)	Cs (mg/kg)
naphthalene	NA	4.77E+09	2.15E-01
n-butylbenzene	1.26E+03	NA	6.18E-03
n-propylbenzene	7.29E+02	NA	5.78E-03
p-cymene	2.94E+03	NA	6.45E-03
phenanthrene	NA	4.77E+09	1.42E-01
pyrene	NA	4.77E+09	1.28E-01
tetrachloroethene	3.02E+02	NA	4.53E-03
trichloroethene	2.72E+02	NA	8.56E-03
xylenes	8.50E+02	NA	6.45E-03

Table B-8 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Inhalation of Particulates and Volatiles

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	3.83E-05	9.00E-03	4.26E-03
1,2,4-trimethylbenzene	2.02E-06	2.00E-03	1.01E-03
1,3,5-trimethylbenzene	1.94E-06	2.00E-03	9.72E-04
aroclor 1248	6.68E-13	7.00E-05	9.54E-09
aroclor 1254	6.68E-13	7.00E-05	9.54E-09
aroclor 1260	7.05E-13	7.00E-05	1.01E-08
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	4.34E-12	4.00E-02	1.09E-10
benzo(a)pyrene	9.18E-12	4.00E-02	2.30E-10
benzo(b)fluoranthene	9.35E-12	4.00E-02	2.34E-10
benzo(k)fluoranthene	8.40E-12	4.00E-02	2.10E-10
bis(2-ethylhexyl)phthalate	4.22E-12	2.00E-02	2.11E-10
chrysene	5.00E-12	4.00E-02	1.25E-10
dibenzo(a,h)anthracene	3.50E-12	4.00E-02	8.75E-11
fluoranthene	4.84E-12	4.00E-01	1.21E-11
indeno(1,2,3-cd)pyrene	8.69E-12	4.00E-02	2.17E-10
naphthalene	8.81E-12	4.00E-02	2.20E-10
n-butylbenzene	9.64E-07	2.90E-01	3.32E-06
n-propylbenzene	1.55E-06	2.90E-01	5.35E-06
p-cymene	4.29E-07	1.00E-01	4.29E-06
phenanthrene	5.82E-12	3.00E-01	1.94E-11
pyrene	5.25E-12	3.00E-01	1.75E-11
tetrachloroethene	2.93E-06	1.00E-01	2.93E-05
trichloroethene	6.16E-06	7.35E-03	8.39E-04
xylenes	1.49E-06	2.00E-01	7.43E-06
	HQ Summation =		7.1E-03

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	5.48E-07	NA	NA
1,2,4-trimethylbenzene	2.89E-08	NA	NA
1,3,5-trimethylbenzene	2.78E-08	NA	NA
aroclor 1248	9.54E-15	7.70E+00	7.35E-14
aroclor 1254	9.54E-15	7.70E+00	7.35E-14
aroclor 1260	1.01E-14	7.70E+00	7.76E-14
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	6.21E-14	3.90E-01	2.42E-14
benzo(a)pyrene	1.31E-13	3.90E+00	5.12E-13
benzo(b)fluoranthene	1.34E-13	3.90E-01	5.21E-14
benzo(k)fluoranthene	1.20E-13	3.90E-01	4.68E-14
bis(2-ethylhexyl)phthalate	6.03E-14	8.40E-03	5.07E-16
chrysene	7.14E-14	3.90E-02	2.79E-15
dibenzo(a,h)anthracene	5.00E-14	4.10E+00	2.05E-13
fluoranthene	6.91E-14	NA	NA
indeno(1,2,3-cd)pyrene	1.24E-13	3.90E-01	4.84E-14
naphthalene	1.26E-13	NA	NA
n-butylbenzene	1.38E-08	NA	NA
n-propylbenzene	2.22E-08	NA	NA
p-cymene	6.13E-09	NA	NA
phenanthrene	8.32E-14	NA	NA
pyrene	7.50E-14	NA	NA
tetrachloroethene	4.19E-08	2.10E-02	8.79E-10
trichloroethene	8.80E-08	1.00E-02	8.80E-10
xylenes	2.12E-08	NA	NA
	ILCR Summation =		1.8E-09

Table B-9
Summary of Potential Health Effects
On-Site Commercial/Industrial Worker AOPC 1

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Indoor Air	6.4E-05
Total Population Hazard Quotient =	6.4E-05

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Indoor Air	1.2E-10
Total Population Incremental Lifetime Cancer Risk =	1.2E-10

Table B-10
Summary of Risk Quantitation
On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Indoor Air

Intake Equation = $\frac{CS \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim indoors	8	h/d
Ci	Concentration of chemicals indoors (indoor + outdoor)	(see Tables 5-6 and 5-7)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	1.64E-05
1,2,4-trimethylbenzene	2.80E-08
1,3,5-trimethylbenzene	5.58E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	1.97E-08
n-propylbenzene	6.01E-08
p-cymene	3.54E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	2.53E-07
trichloroethene	5.45E-07
xylenes	3.82E-08

Table B-10 (cont.)
Summary of Risk Quantitation
On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Indoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	5.32E-07	9.00E-03	5.91E-05
1,2,4-trimethylbenzene	9.09E-10	2.00E-03	4.54E-07
1,3,5-trimethylbenzene	1.81E-09	2.00E-03	9.06E-07
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	6.40E-10	2.90E-01	2.21E-09
n-propylbenzene	1.95E-09	2.90E-01	6.73E-09
p-cymene	1.15E-10	1.00E-01	1.15E-09
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	8.21E-09	1.00E-02	8.21E-07
trichloroethene	1.77E-08	7.35E-03	2.41E-06
xylenes	1.24E-09	2.00E-01	6.20E-09
	HQ Summation =		6.4E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	1.90E-07	NA	NA
1,2,4-trimethylbenzene	3.25E-10	NA	NA
1,3,5-trimethylbenzene	6.47E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	2.28E-10	NA	NA
n-propylbenzene	6.97E-10	NA	NA
p-cymene	4.11E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	2.93E-09	2.10E-02	6.16E-11
trichloroethene	6.32E-09	1.00E-02	6.32E-11
xylenes	4.43E-10	NA	NA
	ILCR Summation =		1.2E-10

Table B-11
Summary of Potential Health Effects
On-Site Commercial/Industrial Worker AOPC 2

Exposure Pathway	**Receptor Hazard Quotient**
Inhalation of Indoor Air	8.7E-05
Total Population Hazard Quotient =	8.7E-05

Exposure Pathway	**Receptor Incremental Lifetime Cancer Risk**
Inhalation of Indoor Air	1.7E-10
Total Population Incremental Lifetime Cancer Risk =	1.7E-10

Table B-12
Summary of Risk Quantitation
On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Indoor Air

Intake Equation = $\frac{CS \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83 m3/h
EF	Exposure frequency	125 days/year
EDn	Exposure duration for non-carcinogens	25 year
EDc	Exposure duration for carcinogens	25 year
BW	Body weight	70 kg
ATc	Average time for carcinogens (lifetime)	25550 days
ATn	Average time for non-carcinogens (EDn x 365)	9125 days
ET	Exposure tim indoor	8 h/d
Ci	Concentration of chemicals indoors (indoor + outdoor)	(see Tables 5-6 and 5-7)

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	2.23E-05
1,2,4-trimethylbenzene	4.45E-08
1,3,5-trimethylbenzene	7.97E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA
naphthalene	NA
n-butylbenzene	2.53E-08
n-propylbenzene	8.01E-08
p-cymene	4.65E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	2.90E-07
trichloroethene	8.25E-07
xylenes	3.01E-08

Table B-12 (cont.)
Summary of Risk Quantitation
On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Indoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	7.24E-07	9.00E-03	8.05E-05
1,2,4-trimethylbenzene	1.45E-09	2.00E-03	7.23E-07
1,3,5-trimethylbenzene	2.59E-09	2.00E-03	1.29E-06
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	8.22E-10	2.90E-01	2.83E-09
n-propylbenzene	2.60E-09	2.90E-01	8.97E-09
p-cymene	1.51E-10	1.00E-01	1.51E-09
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	9.42E-09	1.00E-02	9.42E-07
trichloroethene	2.68E-08	7.35E-03	3.65E-06
xylenes	9.77E-10	2.00E-01	4.88E-09
	HQ Summation =		8.7E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	2.59E-07	NA	NA
1,2,4-trimethylbenzene	5.16E-10	NA	NA
1,3,5-trimethylbenzene	9.25E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	2.94E-10	NA	NA
n-propylbenzene	9.29E-10	NA	NA
p-cymene	5.39E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	3.36E-09	2.10E-02	7.07E-11
trichloroethene	9.57E-09	1.00E-02	9.57E-11
xylenes	3.49E-10	NA	NA
	ILCR Summation =		1.7E-10

Table B-13
Summary of Potential Health Effects
DTSC Commercial/Industrial Worker AOPC 1

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Indoor Air	3.2E-05
Inhalation of Outdoor Air	2.4E-05
Incidental Ingestion of Soil	1.6E-03
Dermal Contact with Soil	2.9E-03
Total Population Hazard Quotient =	4.6E-03

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Indoor Air	6.2E-11
Inhalation of Outdoor Air	7.3E-11
Incidental Ingestion of Soil	7.9E-07
Dermal Contact with Soil	3.6E-06
Total Population Incremental Lifetime Cancer Risk =	4.4E-06

Table B-14
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Incidental Ingestion of Soils

Intake Equation = $\frac{CS \times EF \times ED \times CF \times IR}{BW \times AT}$

IRs	Ingestion rate of soil (RAGS, 1989)	50	mg/day
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	125	d/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	9125	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	Concentration (mg/kg)
1,1-dichloroethene	2.57E-03
1,2,4-trimethylbenzene	3.82E-03
1,3,5-trimethylbenzene	2.96E-03
aroclor 1248	3.69E-02
aroclor 1254	3.28E-02
aroclor 1260	2.08E-02
arsenic	1.56E+00
benzo(a)anthracene	2.43E-01
benzo(a)pyrene	3.39E-01
benzo(b)fluoranthene	3.91E-01
benzo(k)fluoranthene	3.06E-01
bis(2-ethylhexyl)phthalate	2.58E-01
chrysene	2.86E-01
dibenzo(a,h)anthracene	1.36E-01
fluoranthene	2.66E-01
indeno(1,2,3-cd)pyrene	3.33E-01

Compound	Concentration (mg/kg)
naphthalene	2.05E-01
n-butylbenzene	2.81E-03
n-propylbenzene	2.57E-03
p-cymene	2.47E-03
phenanthrene	2.03E-01
pyrene	3.12E-01
tetrachloroethene	2.69E-03
trichloroethene	2.63E-03
xylenes	2.34E-03

Table B-14 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Incidental Ingestion of Soils

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	UH (unitless)
1,1-dichloroethene	6.29E-10	9.00E-03	6.99E-08
1,2,4-trimethylbenzene	9.34E-10	5.00E-01	1.87E-09
1,3,5-trimethylbenzene	7.24E-10	5.00E-01	1.45E-09
aroclor 1248	9.03E-09	7.00E-05	1.29E-04
aroclor 1254	8.02E-09	7.00E-05	1.15E-04
aroclor 1260	5.09E-09	7.00E-05	7.27E-05
arsenic	3.82E-07	3.00E-04	1.27E-03
benzo(a)anthracene	5.94E-08	4.00E-02	1.49E-06
benzo(a)pyrene	8.29E-08	4.00E-02	2.07E-06
benzo(b)fluoranthene	9.56E-08	4.00E-02	2.39E-06
benzo(k)fluoranthene	7.49E-08	4.00E-02	1.87E-06
bis(2-ethylhexyl)phthalate	6.31E-08	2.00E-02	3.16E-06
chrysene	7.00E-08	4.00E-02	1.75E-06
dibenzo(a,h)anthracene	3.33E-08	4.00E-02	8.32E-07
fluoranthene	6.51E-08	4.00E-02	1.63E-06
indeno(1,2,3-cd)pyrene	8.15E-08	4.00E-02	2.04E-06
naphthalene	5.01E-08	4.00E-02	1.25E-06
n-butylbenzene	6.87E-10	1.00E-01	6.87E-09
n-propylbenzene	6.29E-10	1.00E-01	6.29E-09
p-cymene	6.04E-10	1.00E-01	6.04E-09
phenanthrene	4.97E-08	3.00E-01	1.66E-07
pyrene	7.63E-08	3.00E-02	2.54E-06
tetrachloroethene	6.58E-10	1.00E-02	6.58E-08
trichloroethene	6.43E-10	7.35E-03	8.75E-08
xylenes	5.72E-10	2.00E+00	2.86E-10
	HQ Summation =		1.6E-03

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg-d)^{-1}$	UR (unitless)
1,1-dichloroethene	2.25E-10	NA	NA
1,2,4-trimethylbenzene	3.34E-10	NA	NA
1,3,5-trimethylbenzene	2.59E-10	NA	NA
aroclor 1248	3.22E-09	7.70E+00	2.48E-08
aroclor 1254	2.87E-09	7.70E+00	2.21E-08
aroclor 1260	1.82E-09	7.70E+00	1.40E-08
arsenic	1.36E-07	1.50E+00	2.04E-07
benzo(a)anthracene	2.12E-08	1.15E+00	2.44E-08
benzo(a)pyrene	2.96E-08	1.15E+01	3.41E-07
benzo(b)fluoranthene	3.42E-08	1.15E+00	3.93E-08
benzo(k)fluoranthene	2.67E-08	1.15E+00	3.07E-08
bis(2-ethylhexyl)phthalate	2.25E-08	8.40E-03	1.89E-10
chrysene	2.50E-08	1.15E-01	2.87E-09
dibenzo(a,h)anthracene	1.19E-08	4.10E+00	4.87E-08
fluoranthene	2.32E-08	NA	NA
indeno(1,2,3-cd)pyrene	2.91E-08	1.15E+00	3.35E-08
naphthalene	1.79E-08	NA	NA
n-butylbenzene	2.45E-10	NA	NA
n-propylbenzene	2.25E-10	NA	NA
p-cymene	2.16E-10	NA	NA
phenanthrene	1.77E-08	NA	NA
pyrene	2.73E-08	NA	NA
tetrachloroethene	2.35E-10	5.10E-02	1.20E-11
trichloroethene	2.30E-10	1.50E-02	3.45E-12
xylenes	2.04E-10	NA	NA
	ILCR Summation =		7.9E-07

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Table B-15
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Dermal Contact with Soils

Intake Equation = $\frac{CS \times CF \times EF \times ED \times AF \times ABS \times SA}{BW \times AT}$

SA	Surface area of exposed skin (50th percentile, hands only)	2020 cm^2/day
AF	Adherence Factor	1 mg/cm^2
ABS	Absorption factor (see table below)	csv
CF	Conversion factor	1.0E-06 kg/mg
EF	Exposure frequency	125 d/year
EDn	Exposure duration for non-carcinogens	25 year
EDc	Exposure duration for carcinogens	25 year
BW	Body weight	70 kg
ATc	Average time for carcinogens (lifetime)	25550 day
ATn	Average time for non-carcinogens (EDn x 365)	9125 day
CS	Concentration of chemicals in soil	(see Table 5-1)

Chemical Concentrations

Compound	ABS (unitless)	Concentration (mg/kg)
1,1-dichloroethene	1.00E-01	2.57E-03
1,2,4-trimethylbenzene	1.00E-01	3.82E-03
1,3,5-trimethylbenzene	1.00E-01	2.96E-03
aroclor 1248	1.00E-01	3.69E-02
aroclor 1254	1.00E-01	3.28E-02
aroclor 1260	1.00E-01	2.08E-02
arsenic	3.00E-02	1.56E+00
benzo(a)anthracene	1.50E-01	2.43E-01
benzo(a)pyrene	1.50E-01	3.39E-01
benzo(b)fluoranthene	1.50E-01	3.91E-01
benzo(k)fluoranthene	1.50E-01	3.06E-01
bis(2-ethylhexyl)phthalate	1.00E-01	2.58E-01
chrysene	1.50E-01	2.86E-01
dibenzo(a,h)anthracene	1.50E-01	1.36E-01
fluoranthene	1.00E-01	2.66E-01
indeno(1,2,3-cd)pyrene	1.00E-01	3.33E-01

Compound	ABS (unitless)	Concentration (mg/kg)
naphthalene	1.50E-01	2.05E-01
n-butylbenzene	1.00E-01	2.81E-03
n-propylbenzene	1.00E-01	2.57E-03
p-cymene	1.00E-01	2.47E-03
phenanthrene	1.50E-01	2.03E-01
pyrene	1.50E-01	3.12E-01
tetrachloroethene	1.00E-01	2.69E-03
trichloroethene	1.00E-01	2.63E-03
xylenes	1.00E-01	2.34E-03

Table B-15 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Dermal Contact with Soils

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	UH (unitless)
1,1-dichloroethene	2.54E-09	9.00E-03	2.82E-07
1,2,4-trimethylbenzene	3.78E-09	5.00E-01	7.55E-09
1,3,5-trimethylbenzene	2.93E-09	5.00E-01	5.85E-09
aroclor 1248	3.65E-08	7.00E-05	5.21E-04
aroclor 1254	3.24E-08	7.00E-05	4.63E-04
aroclor 1260	2.06E-08	7.00E-05	2.94E-04
arsenic	4.63E-07	3.00E-04	1.54E-03
benzo(a)anthracene	3.60E-07	4.00E-02	9.01E-06
benzo(a)pyrene	5.03E-07	4.00E-02	1.26E-05
benzo(b)fluoranthene	5.80E-07	4.00E-02	1.45E-05
benzo(k)fluoranthene	4.54E-07	4.00E-02	1.13E-05
bis(2-ethylhexyl)phthalate	2.55E-07	2.00E-02	1.27E-05
chrysene	4.24E-07	4.00E-02	1.06E-05
dibenzo(a,h)anthracene	2.02E-07	4.00E-02	5.04E-06
fluoranthene	2.63E-07	4.00E-02	6.57E-06
indeno(1,2,3-cd)pyrene	3.29E-07	4.00E-02	8.23E-06
naphthalene	3.04E-07	4.00E-02	7.60E-06
n-butylbenzene	2.78E-09	1.00E-01	2.78E-08
n-propylbenzene	2.54E-09	1.00E-01	2.54E-08
p-cymene	2.44E-09	1.00E-01	2.44E-08
phenanthrene	3.01E-07	3.00E-01	1.00E-06
pyrene	4.63E-07	3.00E-02	1.54E-05
tetrachloroethene	2.66E-09	1.00E-02	2.66E-07
trichloroethene	2.60E-09	7.35E-03	3.54E-07
xylenes	2.31E-09	2.00E+00	1.16E-09
	HQ Summation =		2.9E-03

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	UR (unitless)
1,1-dichloroethene	9.07E-10	NA	NA
1,2,4-trimethylbenzene	1.35E-09	NA	NA
1,3,5-trimethylbenzene	1.04E-09	NA	NA
aroclor 1248	1.30E-08	7.70E+00	1.00E-07
aroclor 1254	1.16E-08	7.70E+00	8.91E-08
aroclor 1260	7.34E-09	7.70E+00	5.65E-08
arsenic	1.65E-07	1.50E+00	2.48E-07
benzo(a)anthracene	1.29E-07	1.15E+00	1.48E-07
benzo(a)pyrene	1.79E-07	1.15E+01	2.06E-06
benzo(b)fluoranthene	2.07E-07	1.15E+00	2.38E-07
benzo(k)fluoranthene	1.62E-07	1.15E+00	1.86E-07
bis(2-ethylhexyl)phthalate	9.11E-08	8.40E-03	7.65E-10
chrysene	1.51E-07	1.15E-01	1.74E-08
dibenzo(a,h)anthracene	7.20E-08	4.10E+00	2.95E-07
fluoranthene	9.39E-08	NA	NA
indeno(1,2,3-cd)pyrene	1.18E-07	1.15E+00	1.35E-07
naphthalene	1.09E-07	NA	NA
n-butylbenzene	9.92E-10	NA	NA
n-propylbenzene	9.07E-10	NA	NA
p-cymene	8.72E-10	NA	NA
phenanthrene	1.07E-07	NA	NA
pyrene	1.65E-07	NA	NA
tetrachloroethene	9.49E-10	5.10E-02	4.84E-11
trichloroethene	9.28E-10	1.50E-02	1.39E-11
xylenes	8.26E-10	NA	NA
	ILCR Summation =		3.6E-06

Table B-16
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Indoor Air

Intake Equation = $\frac{Ci \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim indoor	4	h/d
Ci	Concentration of chemicals indoors (indoor + outdoor)	(see Tables 5-6 and 5-7)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	1.64E-05
1,2,4-trimethylbenzene	2.80E-08
1,3,5-trimethylbenzene	5.58E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	1.97E-08
n-propylbenzene	6.01E-08
p-cymene	3.54E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	2.53E-07
trichloroethene	5.45E-07
xylenes	3.82E-08

Table B-16 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Indoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.66E-07	9.00E-03	2.95E-05
1,2,4-trimethylbenzene	4.54E-10	2.00E-03	2.27E-07
1,3,5-trimethylbenzene	9.06E-10	2.00E-03	4.53E-07
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	3.20E-10	2.90E-01	1.10E-09
n-propylbenzene	9.76E-10	2.90E-01	3.37E-09
p-cymene	5.75E-11	1.00E-01	5.75E-10
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	4.11E-09	1.00E-02	4.11E-07
trichloroethene	8.85E-09	7.35E-03	1.20E-06
xylenes	6.20E-10	2.00E-01	3.10E-09
	HQ Summation =		3.2E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	9.50E-08	NA	NA
1,2,4-trimethylbenzene	1.62E-10	NA	NA
1,3,5-trimethylbenzene	3.24E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	1.14E-10	NA	NA
n-propylbenzene	3.49E-10	NA	NA
p-cymene	2.05E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	1.47E-09	2.10E-02	3.08E-11
trichloroethene	3.16E-09	1.00E-02	3.16E-11
xylenes	2.22E-10	NA	NA
	ILCR Summation =		6.2E-11

Table B-17
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Outdoor Air

Intake Equation = $\frac{\{Ci + (Cs \times 1/PEF)\} \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim outdoor	4	h/d
Ci	Concentration of volatiles in ambient air	(see Table 5-6)	
PEF	Particulate Emission Factor (see Table below)	(see Section 5.3.1.2)	

Chemical Concentrations

Compound	Soil Conc (mg/kg)	PEF (m3/kg)	Volatile Concentration (mg/m3)
1,1-dichloroethene	2.57E-03	NA	1.24E-05
1,2,4-trimethylbenzene	3.82E-03	NA	2.38E-08
1,3,5-trimethylbenzene	2.96E-03	NA	4.37E-08
aroclor 1248	3.69E-02	4.77E+09	NA
aroclor 1254	3.28E-02	4.77E+09	NA
aroclor 1260	2.08E-02	4.77E+09	NA
arsenic	1.56E+00	4.77E+09	NA
benzo(a)anthracene	2.43E-01	4.77E+09	NA
benzo(a)pyrene	3.39E-01	4.77E+09	NA
benzo(b)fluoranthene	3.91E-01	4.77E+09	NA
benzo(k)fluoranthene	3.06E-01	4.77E+09	NA
bis(2-ethylhexyl)phtha	2.58E-01	4.77E+09	NA
chrysene	2.86E-01	4.77E+09	NA
dibenzo(a,h)anthracene	1.36E-01	4.77E+09	NA
fluoranthene	2.66E-01	4.77E+09	NA
indeno(1,2,3-cd)pyrene	3.33E-01	4.77E+09	NA

Compound	Soil Conc (mg/k	PEF	Volatile Concentration (mg/m3)
naphthalene	2.05E-01	4.77E+09	NA
n-butylbenzene	2.81E-03	NA	1.43E-08
n-propylbenzene	2.57E-03	NA	4.48E-08
p-cymene	2.47E-03	NA	2.61E-09
phenanthrene	2.03E-01	4.77E+09	NA
pyrene	3.12E-01	4.77E+09	NA
tetrachloroethene	2.69E-03	NA	1.70E-07
trichloroethene	2.63E-03	NA	4.46E-07
xylenes	2.34E-03	NA	2.79E-08

Table B-17 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Outdoor Air

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.01E-07	9.00E-03	2.24E-05
1,2,4-trimethylbenzene	3.87E-10	2.00E-03	1.93E-07
1,3,5-trimethylbenzene	7.10E-10	2.00E-03	3.55E-07
aroclor 1248	1.26E-13	7.00E-05	1.79E-09
aroclor 1254	1.12E-13	7.00E-05	1.59E-09
aroclor 1260	7.08E-14	7.00E-05	1.01E-09
arsenic	5.31E-12	3.00E-04	1.77E-08
benzo(a)anthracene	8.27E-13	4.00E-02	2.07E-11
benzo(a)pyrene	1.15E-12	4.00E-02	2.88E-11
benzo(b)fluoranthene	1.33E-12	4.00E-02	3.33E-11
benzo(k)fluoranthene	1.04E-12	4.00E-02	2.60E-11
bis(2-ethylhexyl)phthalate	8.78E-13	2.00E-02	4.39E-11
chrysene	9.73E-13	4.00E-02	2.43E-11
dibenzo(a,h)anthracene	4.63E-13	4.00E-02	1.16E-11
fluoranthene	9.05E-13	4.00E-02	2.26E-11
indeno(1,2,3-cd)pyrene	1.13E-12	4.00E-02	2.83E-11
naphthalene	6.97E-13	4.00E-02	1.74E-11
n-butylbenzene	2.32E-10	2.90E-01	8.01E-10
n-propylbenzene	7.28E-10	2.90E-01	2.51E-09
p-cymene	4.24E-11	1.00E-01	4.24E-10
phenanthrene	6.91E-13	3.00E-01	2.30E-12
pyrene	1.06E-12	3.00E-02	3.54E-11
tetrachloroethene	2.76E-09	1.00E-02	2.76E-07
trichloroethene	7.24E-09	7.35E-03	9.86E-07
xylenes	4.53E-10	2.00E-01	2.27E-09
	HQ Summation =		2.4E-05

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	7.19E-08	NA	NA
1,2,4-trimethylbenzene	1.38E-10	NA	NA
1,3,5-trimethylbenzene	2.54E-10	NA	NA
aroclor 1248	4.48E-14	7.70E+00	3.45E-13
aroclor 1254	3.99E-14	7.70E+00	3.07E-13
aroclor 1260	2.53E-14	7.70E+00	1.95E-13
arsenic	1.90E-12	1.20E+01	2.27E-11
benzo(a)anthracene	2.95E-13	3.90E-01	1.15E-13
benzo(a)pyrene	4.12E-13	3.90E+00	1.61E-12
benzo(b)fluoranthene	4.75E-13	3.90E-01	1.85E-13
benzo(k)fluoranthene	3.72E-13	3.90E-01	1.45E-13
bis(2-ethylhexyl)phthalate	3.13E-13	8.40E-03	2.63E-15
chrysene	3.48E-13	3.90E-02	1.36E-14
dibenzo(a,h)anthracene	1.65E-13	4.10E+00	6.78E-13
fluoranthene	3.23E-13	NA	NA
indeno(1,2,3-cd)pyrene	4.05E-13	3.90E-01	1.58E-13
naphthalene	2.49E-13	NA	NA
n-butylbenzene	8.30E-11	NA	NA
n-propylbenzene	2.60E-10	NA	NA
p-cymene	1.51E-11	NA	NA
phenanthrene	2.47E-13	NA	NA
pyrene	3.79E-13	NA	NA
tetrachloroethene	9.86E-10	2.10E-02	2.07E-11
trichloroethene	2.59E-09	1.00E-02	2.59E-11
xylenes	1.62E-10	NA	NA
	ILCR Summation =		7.3E-11

Table B-18
Summary of Potential Health Effects
DTSC Commercial/Industrial Worker AOPC 2

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Indoor Air	4.4E-05
Inhalation of Outdoor Air	2.4E-05
Incidental Ingestion of Soil	1.9E-04
Dermal Contact with Soil	7.7E-04
Total Population Hazard Quotient =	1.0E-03

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Indoor Air	8.3E-11
Inhalation of Outdoor Air	4.9E-11
Incidental Ingestion of Soil	3.7E-07
Dermal Contact with Soil	2.1E-06
Total Population Incremental Lifetime Cancer Risk =	2.5E-06

Table B-19
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Incidental Ingestion of Soils

Intake Equation = $\frac{CS \times EF \times ED \times CF \times IR}{BW \times AT}$

IRs	Ingestion rate of soil (RAGS, 1989)	50	mg/day
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	125	d/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	9125	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	Concentration (mg/kg)	Compound	Concentration (mg/kg)
1,1-dichloroethene	4.05E-03	naphthalene	2.15E-01
1,2,4-trimethylbenzene	1.85E-02	n-butylbenzene	6.18E-03
1,3,5-trimethylbenzene	8.93E-03	n-propylbenzene	5.78E-03
aroclor 1248	1.63E-02	p-cymene	6.45E-03
aroclor 1254	1.63E-02	phenanthrene	1.42E-01
aroclor 1260	1.72E-02	pyrene	1.28E-01
arsenic		tetrachloroethene	4.53E-03
benzo(a)anthracene	1.06E-01	trichloroethene	8.56E-03
benzo(a)pyrene	2.24E-01	xylenes	6.45E-03
benzo(b)fluoranthene	2.28E-01		
benzo(k)fluoranthene	2.05E-01		
bis(2-ethylhexyl)phthalate	1.03E-01		
chrysene	1.22E-01		
dibenzo(a,h)anthracene	8.54E-02		
fluoranthene	1.18E-01		
indeno(1,2,3-cd)pyrene	2.12E-01		

Table B-19 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Incidental Ingestion of Soils

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	UH (unitless)
1,1-dichloroethene	9.91E-10	9.00E-03	1.10E-07
1,2,4-trimethylbenzene	4.53E-09	5.00E-01	9.05E-09
1,3,5-trimethylbenzene	2.18E-09	5.00E-01	4.37E-09
aroclor 1248	3.99E-09	7.00E-05	5.70E-05
aroclor 1254	3.99E-09	7.00E-05	5.70E-05
aroclor 1260	4.21E-09	7.00E-05	6.01E-05
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	2.59E-08	4.00E-02	6.48E-07
benzo(a)pyrene	5.48E-08	4.00E-02	1.37E-06
benzo(b)fluoranthene	5.58E-08	4.00E-02	1.39E-06
benzo(k)fluoranthene	5.01E-08	4.00E-02	1.25E-06
bis(2-ethylhexyl)phthalate	2.52E-08	2.00E-02	1.26E-06
chrysene	2.98E-08	4.00E-02	7.46E-07
dibenzo(a,h)anthracene	2.09E-08	4.00E-02	5.22E-07
fluoranthene	2.89E-08	4.00E-02	7.22E-07
indeno(1,2,3-cd)pyrene	5.19E-08	4.00E-02	1.30E-06
naphthalene	5.26E-08	4.00E-02	1.31E-06
n-butylbenzene	1.51E-09	1.00E-01	1.51E-08
n-propylbenzene	1.41E-09	1.00E-01	1.41E-08
p-cymene	1.58E-09	1.00E-01	1.58E-08
phenanthrene	3.47E-08	3.00E-01	1.16E-07
pyrene	3.13E-08	3.00E-02	1.04E-06
tetrachloroethene	1.11E-09	1.00E-02	1.11E-07
trichloroethene	2.09E-09	7.35E-03	2.85E-07
xylenes	1.58E-09	2.00E+00	7.89E-10
	HQ Summation =		1.9E-04

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF (mg/kg-d)-1	UR (unitless)
1,1-dichloroethene	3.54E-10	NA	NA
1,2,4-trimethylbenzene	1.62E-09	NA	NA
1,3,5-trimethylbenzene	7.80E-10	NA	NA
aroclor 1248	1.42E-09	7.70E+00	1.10E-08
aroclor 1254	1.42E-09	7.70E+00	1.10E-08
aroclor 1260	1.50E-09	7.70E+00	1.16E-08
arsenic	NA	1.50E+00	NA
benzo(a)anthracene	9.26E-09	1.15E+00	1.06E-08
benzo(a)pyrene	1.96E-08	1.15E+01	2.25E-07
benzo(b)fluoranthene	1.99E-08	1.15E+00	2.29E-08
benzo(k)fluoranthene	1.79E-08	1.15E+00	2.06E-08
bis(2-ethylhexyl)phthalate	9.00E-09	8.40E-03	7.56E-11
chrysene	1.07E-08	1.15E-01	1.23E-09
dibenzo(a,h)anthracene	7.46E-09	4.10E+00	3.06E-08
fluoranthene	1.03E-08	NA	NA
indeno(1,2,3-cd)pyrene	1.85E-08	1.15E+00	2.13E-08
naphthalene	1.88E-08	NA	NA
n-butylbenzene	5.40E-10	NA	NA
n-propylbenzene	5.05E-10	NA	NA
p-cymene	5.63E-10	NA	NA
phenanthrene	1.24E-08	NA	NA
pyrene	1.12E-08	NA	NA
tetrachloroethene	3.96E-10	5.10E-02	2.02E-11
trichloroethene	7.48E-10	1.50E-02	1.12E-11
xylenes	5.63E-10	NA	NA
	ILCR Summation =		3.7E-07

Table B-20
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Dermal Contact with Soils

Intake Equation = $\frac{CS \times CF \times EF \times ED \times AF \times ABS \times SA}{BW \times AT}$

SA	Surface area of exposed skin (50th percentile, hands only)	2020	cm2/day
AF	Adherence Factor	1	mg/cm2
ABS	Absorption factor (see table below)	csv	
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	125	d/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	9125	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	ABS (unitless)	Concentration (mg/kg)
1,1-dichloroethene	1.00E-01	4.05E-03
1,2,4-trimethylbenzene	1.00E-01	1.85E-02
1,3,5-trimethylbenzene	1.00E-01	8.93E-03
aroclor 1248	1.00E-01	1.63E-02
aroclor 1254	1.00E-01	1.63E-02
aroclor 1260	1.00E-01	1.72E-02
arsenic	3.00E-02	NA
benzo(a)anthracene	1.50E-01	1.06E-01
benzo(a)pyrene	1.50E-01	2.24E-01
benzo(b)fluoranthene	1.50E-01	2.28E-01
benzo(k)fluoranthene	1.50E-01	2.05E-01
bis(2-ethylhexyl)phthalate	1.00E-01	1.03E-01
chrysene	1.50E-01	1.22E-01
dibenzo(a,h)anthracene	1.50E-01	8.54E-02
fluoranthene	1.00E-01	1.18E-01
indeno(1,2,3-cd)pyrene	1.00E-01	2.12E-01

Compound	ABS (unitless)	Concentration (mg/kg)
naphthalene	1.50E-01	2.15E-01
n-butylbenzene	1.00E-01	6.18E-03
n-propylbenzene	1.00E-01	5.78E-03
p-cymene	1.00E-01	6.45E-03
phenanthrene	1.50E-01	1.42E-01
pyrene	1.50E-01	1.28E-01
tetrachloroethene	1.00E-01	4.53E-03
trichloroethene	1.00E-01	8.56E-03
xylenes	1.00E-01	6.45E-03

Table B-20 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Dermal Contact with Soils

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	UH (unitless)
1,1-dichloroethene	4.00E-09	9.00E-03	4.45E-07
1,2,4-trimethylbenzene	1.83E-08	5.00E-01	3.66E-08
1,3,5-trimethylbenzene	8.83E-09	5.00E-01	1.77E-08
aroclor 1248	1.61E-08	7.00E-05	2.30E-04
aroclor 1254	1.61E-08	7.00E-05	2.30E-04
aroclor 1260	1.70E-08	7.00E-05	2.43E-04
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	1.57E-07	4.00E-02	3.93E-06
benzo(a)pyrene	3.32E-07	4.00E-02	8.30E-06
benzo(b)fluoranthene	3.38E-07	4.00E-02	8.45E-06
benzo(k)fluoranthene	3.04E-07	4.00E-02	7.60E-06
bis(2-ethylhexyl)phthalate	1.02E-07	2.00E-02	5.09E-06
chrysene	1.81E-07	4.00E-02	4.52E-06
dibenzo(a,h)anthracene	1.27E-07	4.00E-02	3.16E-06
fluoranthene	1.17E-07	4.00E-02	2.92E-06
indeno(1,2,3-cd)pyrene	2.10E-07	4.00E-02	5.24E-06
naphthalene	3.19E-07	4.00E-02	7.97E-06
n-butylbenzene	6.11E-09	1.00E-01	6.11E-08
n-propylbenzene	5.71E-09	1.00E-01	5.71E-08
p-cymene	6.37E-09	1.00E-01	6.37E-08
phenanthrene	2.10E-07	3.00E-01	7.02E-07
pyrene	1.90E-07	3.00E-02	6.32E-06
tetrachloroethene	4.48E-09	1.00E-02	4.48E-07
trichloroethene	8.46E-09	7.35E-03	1.15E-06
xylenes	6.37E-09	2.00E+00	3.19E-09
	HQ Summation =		7.7E-04

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	UR (unitless)
1,1-dichloroethene	1.43E-09	NA	NA
1,2,4-trimethylbenzene	6.53E-09	NA	NA
1,3,5-trimethylbenzene	3.15E-09	NA	NA
aroclor 1248	5.75E-09	7.70E+00	4.43E-08
aroclor 1254	5.75E-09	7.70E+00	4.43E-08
aroclor 1260	6.07E-09	7.70E+00	4.67E-08
arsenic	NA	1.50E+00	NA
benzo(a)anthracene	5.61E-08	1.15E+00	6.45E-08
benzo(a)pyrene	1.19E-07	1.15E+01	1.36E-06
benzo(b)fluoranthene	1.21E-07	1.15E+00	1.39E-07
benzo(k)fluoranthene	1.09E-07	1.15E+00	1.25E-07
bis(2-ethylhexyl)phthalate	3.64E-08	8.40E-03	3.05E-10
chrysene	6.46E-08	1.15E-01	7.43E-09
dibenzo(a,h)anthracene	4.52E-08	4.10E+00	1.85E-07
fluoranthene	4.16E-08	NA	NA
indeno(1,2,3-cd)pyrene	7.48E-08	1.15E+00	8.60E-08
naphthalene	1.14E-07	NA	NA
n-butylbenzene	2.18E-09	NA	NA
n-propylbenzene	2.04E-09	NA	NA
p-cymene	2.28E-09	NA	NA
phenanthrene	7.52E-08	NA	NA
pyrene	6.78E-08	NA	NA
tetrachloroethene	1.60E-09	5.10E-02	8.15E-11
trichloroethene	3.02E-09	1.50E-02	4.53E-11
xylenes	2.28E-09	NA	NA
	ILCR Summation =		2.1E-06

Table B-21
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Indoor Air

Intake Equation = $\frac{Ci \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim indoor	4	h/d
Ci	Concentration of chemicals indoors (indoor + outdoor)	(see Tables 5-6 and 5-7)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	2.23E-05
1,2,4-trimethylbenzene	4.45E-08
1,3,5-trimethylbenzene	7.97E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	2.53E-08
n-propylbenzene	8.01E-08
p-cymene	4.65E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	2.90E-07
trichloroethene	8.25E-07
xylenes	3.01E-08

Table B-21 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Indoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	3.62E-07	9.00E-03	4.02E-05
1,2,4-trimethylbenzene	7.23E-10	2.00E-03	3.61E-07
1,3,5-trimethylbenzene	1.29E-09	2.00E-03	6.47E-07
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	4.11E-10	2.90E-01	1.42E-09
n-propylbenzene	1.30E-09	2.90E-01	4.49E-09
p-cymene	7.55E-11	1.00E-01	7.55E-10
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	4.71E-09	1.00E-02	4.71E-07
trichloroethene	1.34E-08	7.35E-03	1.82E-06
xylenes	4.88E-10	2.00E-01	2.44E-09
	HQ Summation =		4.4E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	1.29E-07	NA	NA
1,2,4-trimethylbenzene	2.58E-10	NA	NA
1,3,5-trimethylbenzene	4.62E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	1.47E-10	NA	NA
n-propylbenzene	4.65E-10	NA	NA
p-cymene	2.70E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	1.68E-09	2.10E-02	3.53E-11
trichloroethene	4.79E-09	1.00E-02	4.79E-11
xylenes	1.74E-10	NA	NA
	ILCR Summation =		8.3E-11

Table B-22
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Outdoor Air

Intake Equation = $$\frac{\{Ci + (Cs \times 1/PEF)\} \times EF \times ED \times ET \times IR}{BW \times AT}$$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim outdoor	4	h/d
Ci	Concentration of chemicals outdoors	(see Table 5-6)	
PEF	Particulate Emission Factor	(see Section 5.3.1.2)	

Chemical Concentrations

Compound	Soil Conc (mg/kg)	PEF (m3/kg)	Volatile Concentration (mg/m3)
1,1-dichloroethene	4.05E-03	NA	1.24E-05
1,2,4-trimethylbenzen	1.85E-02	NA	2.38E-08
1,3,5-trimethylbenzen	8.93E-03	NA	4.37E-08
aroclor 1248	1.63E-02	4.77E+09	NA
aroclor 1254	1.63E-02	4.77E+09	NA
aroclor 1260	1.72E-02	4.77E+09	NA
arsenic	NA	4.77E+09	NA
benzo(a)anthracene	1.06E-01	4.77E+09	NA
benzo(a)pyrene	2.24E-01	4.77E+09	NA
benzo(b)fluoranthene	2.28E-01	4.77E+09	NA
benzo(k)fluoranthene	2.05E-01	4.77E+09	NA
bis(2-ethylhexyl)phtha	1.03E-01	4.77E+09	NA
chrysene	1.22E-01	4.77E+09	NA
dibenzo(a,h)anthracen	8.54E-02	4.77E+09	NA
fluoranthene	1.18E-01	4.77E+09	NA
indeno(1,2,3-cd)pyren	2.12E-01	4.77E+09	NA

Compound	Soil Conc (mg/k	PEF	Volatile Concentration (mg/m3)
naphthalene	2.15E-01	4.77E+09	NA
n-butylbenzene	6.18E-03	NA	1.43E-08
n-propylbenzene	5.78E-03	NA	4.48E-08
p-cymene	6.45E-03	NA	2.61E-09
phenanthrene	1.42E-01	4.77E+09	NA
pyrene	1.28E-01	4.77E+09	NA
tetrachloroethene	4.53E-03	NA	1.70E-07
trichloroethene	8.56E-03	NA	4.46E-07
xylenes	6.45E-03	NA	2.79E-08

Table B-22 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Outdoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.01E-07	9.00E-03	2.24E-05
1,2,4-trimethylbenzene	3.87E-10	2.00E-03	1.93E-07
1,3,5-trimethylbenzene	7.10E-10	2.00E-03	3.55E-07
aroclor 1248	5.55E-14	7.00E-05	7.92E-10
aroclor 1254	5.55E-14	7.00E-05	7.92E-10
aroclor 1260	5.85E-14	7.00E-05	8.36E-10
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	3.61E-13	4.00E-02	9.02E-12
benzo(a)pyrene	7.62E-13	4.00E-02	1.91E-11
benzo(b)fluoranthene	7.76E-13	4.00E-02	1.94E-11
benzo(k)fluoranthene	6.97E-13	4.00E-02	1.74E-11
bis(2-ethylhexyl)phthalate	3.50E-13	2.00E-02	1.75E-11
chrysene	4.15E-13	4.00E-02	1.04E-11
dibenzo(a,h)anthracene	2.91E-13	4.00E-02	7.26E-12
fluoranthene	4.01E-13	4.00E-02	1.00E-11
indeno(1,2,3-cd)pyrene	7.21E-13	4.00E-02	1.80E-11
naphthalene	7.31E-13	4.00E-02	1.83E-11
n-butylbenzene	2.32E-10	2.90E-01	8.01E-10
n-propylbenzene	7.28E-10	2.90E-01	2.51E-09
p-cymene	4.24E-11	1.00E-01	4.24E-10
phenanthrene	4.83E-13	3.00E-01	1.61E-12
pyrene	4.35E-13	3.00E-02	1.45E-11
tetrachloroethene	2.76E-09	1.00E-02	2.76E-07
trichloroethene	7.24E-09	7.35E-03	9.86E-07
xylenes	4.53E-10	2.00E-01	2.27E-09
	HQ Summation =		2.4E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	7.19E-08	NA	NA
1,2,4-trimethylbenzene	1.38E-10	NA	NA
1,3,5-trimethylbenzene	2.54E-10	NA	NA
aroclor 1248	1.98E-14	7.70E+00	1.53E-13
aroclor 1254	1.98E-14	7.70E+00	1.53E-13
aroclor 1260	2.09E-14	7.70E+00	1.61E-13
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	1.29E-13	3.90E-01	5.02E-14
benzo(a)pyrene	2.72E-13	3.90E+00	1.06E-12
benzo(b)fluoranthene	2.77E-13	3.90E-01	1.08E-13
benzo(k)fluoranthene	2.49E-13	3.90E-01	9.71E-14
bis(2-ethylhexyl)phthalate	1.25E-13	8.40E-03	1.05E-15
chrysene	1.48E-13	3.90E-02	5.78E-15
dibenzo(a,h)anthracene	1.04E-13	4.10E+00	4.25E-13
fluoranthene	1.43E-13	NA	NA
indeno(1,2,3-cd)pyrene	2.58E-13	3.90E-01	1.00E-13
naphthalene	2.61E-13	NA	NA
n-butylbenzene	8.30E-11	NA	NA
n-propylbenzene	2.60E-10	NA	NA
p-cymene	1.51E-11	NA	NA
phenanthrene	1.73E-13	NA	NA
pyrene	1.56E-13	NA	NA
tetrachloroethene	9.86E-10	2.10E-02	2.07E-11
trichloroethene	2.59E-09	1.00E-02	2.59E-11
xylenes	1.62E-10	NA	NA
	ILCR Summation =		4.9E-11

Table B-23
Summary of Potential Health Effects
Off-Site Commercial/Industrial Worker

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Outdoor Air	2.5E-05
Total Population Hazard Quotient =	2.5E-05

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Outdoor Air	5.2E-11
Total Population Incremental Lifetime Cancer Risk =	5.2E-11

Table B-24
Summary of Risk Quantitation
Off-Site Commercial/Industrial Worker
Via Inhalation of Outdoor Air

Intake Equation = $\frac{CS \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83 m3/h
EF	Exposure frequency	125 days/year
EDn	Exposure duration for non-carcinogens	25 year
EDc	Exposure duration for carcinogens	25 year
BW	Body weight	70 kg
ATc	Average time for carcinogens (lifetime)	25550 days
ATn	Average time for non-carcinogens (EDn x 365)	9125 days
ET	Exposure time outdoors	8 h/d
Ci	Concentration of chemicals indoors	(see Table 5-6)

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	6.57E-06
1,2,4-trimethylbenzene	7.04E-09
1,3,5-trimethylbenzene	2.01E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	8.90E-09
n-propylbenzene	2.54E-08
p-cymene	1.54E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	1.36E-07
trichloroethene	1.66E-07
xylenes	1.70E-08

Table B-24 (cont.)
Summary of Risk Quantitation
Off-Site Commercial/Industrial Worker
Via Inhalation of Outdoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.13E-07	9.00E-03	2.37E-05
1,2,4-trimethylbenzene	2.29E-10	2.00E-03	1.14E-07
1,3,5-trimethylbenzene	6.53E-10	2.00E-03	3.26E-07
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	2.89E-10	2.90E-01	9.97E-10
n-propylbenzene	8.25E-10	2.90E-01	2.85E-09
p-cymene	5.00E-11	1.00E-01	5.00E-10
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	4.42E-09	1.00E-02	4.42E-07
trichloroethene	5.39E-09	7.35E-03	7.34E-07
xylenes	5.52E-10	2.00E-01	2.76E-09
	HQ Summation =		2.5E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	7.62E-08	NA	NA
1,2,4-trimethylbenzene	8.17E-11	NA	NA
1,3,5-trimethylbenzene	2.33E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	1.03E-10	NA	NA
n-propylbenzene	2.95E-10	NA	NA
p-cymene	1.79E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	1.58E-09	2.10E-02	3.31E-11
trichloroethene	1.93E-09	1.00E-02	1.93E-11
xylenes	1.97E-10	NA	NA
	ILCR Summation =		5.2E-11

Table B-25
Summary of Potential Health Effects
Off-Site RME Resident Adult

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Outdoor Air	1.2E-06
Total Population Hazard Quotient =	1.2E-06

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Outdoor Air	2.9E-12
Total Population Incremental Lifetime Cancer Risk =	2.9E-12

Table B-26
Summary of Risk Quantitation
Off-Site RME Resident Adult
Via Inhalation of Outdoor Air

Intake Equation =

$$\frac{CS \times EF \times ED \times ET \times IR}{BW \times AT}$$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	350	days/year
EDn	Exposure duration for non-carcinogens	30	year
EDc	Exposure duration for carcinogens	30	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	10950	days
ET	Exposure time	24	h/d
Ci	Concentration of chemicals Outdoors	(see Table 5-6)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	3.65E-08
1,2,4-trimethylbenzene	3.83E-11
1,3,5-trimethylbenzene	1.11E-10
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	4.96E-11
n-propylbenzene	1.41E-10
p-cymene	8.57E-12
phenanthrene	NA
pyrene	NA
tetrachloroethene	7.61E-10
trichloroethene	9.09E-10
xylenes	9.47E-11

Table B-26 (cont.)
Summary of Risk Quantitation
Off-Site RME Resident Adult
Via Inhalation of Outdoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	9.96E-09	9.00E-03	1.11E-06
1,2,4-trimethylbenzene	1.05E-11	2.00E-03	5.23E-09
1,3,5-trimethylbenzene	3.03E-11	2.00E-03	1.51E-08
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	1.35E-11	2.90E-01	4.67E-11
n-propylbenzene	3.85E-11	2.90E-01	1.33E-10
p-cymene	2.34E-12	1.00E-01	2.34E-11
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	2.08E-10	1.00E-02	2.08E-08
trichloroethene	2.48E-10	7.35E-03	3.37E-08
xylenes	2.58E-11	2.00E-01	1.29E-10
	HQ Summation =		1.2E-06

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	4.27E-09	NA	NA
1,2,4-trimethylbenzene	4.48E-12	NA	NA
1,3,5-trimethylbenzene	1.30E-11	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	5.80E-12	NA	NA
n-propylbenzene	1.65E-11	NA	NA
p-cymene	1.00E-12	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	8.90E-11	2.10E-02	1.87E-12
trichloroethene	1.06E-10	1.00E-02	1.06E-12
xylenes	1.11E-11	NA	NA
	ILCR Summation =		2.9E-12

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Table B-27
Summary of Potential Health Effects
Off-Site RME Resident Child

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Outdoor Air	5.5E-06
Total Population Hazard Quotient =	5.5E-06

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Outdoor Air	2.7E-12
Total Population Incremental Lifetime Cancer Risk =	2.7E-12

Table B-28
Summary of Risk Quantitation
Off-Site RME Resident Child
Via Inhalation of Outdoor Air

Intake Equation $= \dfrac{\text{CS X EF X ED X ET X IR}}{\text{BW X AT}}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m^3/h
EF	Exposure frequency	350	days/year
EDn	Exposure duration for non-carcinogens	6	year
EDc	Exposure duration for carcinogens	6	year
BW	Body weight	15	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	2190	days
ET	Exposure time	24	h/d
Ci	Concentration of chemicals Outdoors	(see Table 5-6)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	3.65E-08
1,2,4-trimethylbenzene	3.83E-11
1,3,5-trimethylbenzene	1.11E-10
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	4.96E-11
n-propylbenzene	1.41E-10
p-cymene	8.57E-12
phenanthrene	NA
pyrene	NA
tetrachloroethene	7.61E-10
trichloroethene	9.09E-10
xylenes	9.47E-11

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Table B-28 (cont.)
Summary of Risk Quantitation
Off-Site RME Resident Child
Via Inhalation of Outdoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	4.65E-08	9.00E-03	5.16E-06
1,2,4-trimethylbenzene	4.88E-11	2.00E-03	2.44E-08
1,3,5-trimethylbenzene	1.41E-10	2.00E-03	7.07E-08
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	6.32E-11	2.90E-01	2.18E-10
n-propylbenzene	1.80E-10	2.90E-01	6.19E-10
p-cymene	1.09E-11	1.00E-01	1.09E-10
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	9.69E-10	1.00E-02	9.69E-08
trichloroethene	1.16E-09	7.35E-03	1.57E-07
xylenes	1.21E-10	2.00E-01	6.03E-10
	HQ Summation =		5.5E-06

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)$^{-1}$	ILCR (unitless)
1,1-dichloroethene	3.98E-09	NA	NA
1,2,4-trimethylbenzene	4.18E-12	NA	NA
1,3,5-trimethylbenzene	1.21E-11	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	5.41E-12	NA	NA
n-propylbenzene	1.54E-11	NA	NA
p-cymene	9.35E-13	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	8.31E-11	2.10E-02	1.74E-12
trichloroethene	9.92E-11	1.00E-02	9.92E-13
xylenes	1.03E-11	NA	NA
	ILCR Summation =		2.7E-12

INTEGRATED
Environmental Services, Inc.

April 13, 1998

Via Facsimile and Federal Express

James E. Ross, P.E.
Unit Chief, Site Cleanup Unit
Regional Water Quality Control Board
Los Angeles Region
101 Center Plaza Drive
Monterey Park, CA 91754-2156

Subject: Response to RWQCB Memo re. *Post-Demolition Risk Assessment*, March 31, 1998

Project: Boeing C-6 Facility, Parcel A, Los Angeles (RWQCB File No. 100.315)

Dear Mr. Ross:

On behalf of Boeing Realty Corporation, Integrated Environmental Services Inc. is pleased to submit for your review the attached document pertaining to the C-6 facility, Parcel A. We are delighted to report that the incorporation of the Regional Water Quality Control Board's (RWQCB's) review comments has resulted in a reduction of projected risks. However, the fundamental finding of the risk assessment, "no significant risk," has not been altered. The proposed change pages for the RWQCB comments have been enclosed for your review. In addition, this document has been prepared so that it may be incorporated into the final post-demolition risk assessment front matter.

Comment 1: Our Calculation for the following equations, using the data provided, indicated the following:

Equation	*Site-specific soil parameters*	*PDRA soil parameters*
5-5 (g/cm3)	*1.45E-3*	*2.63E-3*
5-12 (mg/cm2-s)	*2.32E-15*	*7.32E-13*

Please provide recalculations of the above and enter the appropriate values.

Response: Equation 5-5 of the post-demolition risk assessment should read as follows:

$$K_{as} = H'/(R \times T \times K_d) \qquad (5\text{-}5)$$

where

- H' = COPC-specific Henry's Law constant (atm-m^3/mol), from Table 5-3
- R = ideal gas constant, 8.206 x 10^{-5} atm-m^3/mol/K
- T = temperature in Kelvin, 293 K
- K_d = soil-to-water partitioning coefficient (cm^3/g), K_{OC} from Table 5-3 times fraction of organic carbon in soil matrix, 0.004 unitless (Cal/EPA 1994)

3990 Westerly Place, Suite 210 ◆ Newport Beach, CA 92660 ◆ Tel: (714) 852-9050 ◆ Fax: (714) 852-9011

Integrated has provided a change page (5-12) to address these corrections. The K_{as} values calculated in the post-demolition risk assessment and the response to RWQCB's March 11, 1998 review comments are correct.

Integrated concurs with RWQCB findings for the calculated flux rates presented in Section 5 of the post-demolition risk assessment and the response to RWQCB comments dated March 20, 1998. The unit conversion factor presented in equation 5-12 was not included in the calculation of AOPC flux rates. The impact of this inadvertent omission was to overestimate potential risks by three orders of magnitude for exposures to outdoor air. Cumulative effects on the findings of the post-demolition risk assessment and associated potential health impacts are insignificant. However, the proposed change pages (5-20, 5-23, 6-12, 8-3, and Appendix B) have been enclosed to allow the reviewer to replicate the exposure assessment process.

Comment 2: The following revisions must be made in the report:

1. *The March 20, 1998, response stated that "The D'Agostino's test results were inconclusive..." and this determination should be stated in the final report page 5-5, and any other relevant sections in the report. Please also clearly describe the determination of data distribution in the report, i.e., that the determination is based on histogram plots, not on the results of the D'Agostino's test.*

   Response: Text has been added to pages 5-4 and 5-5. The proposed change pages are enclosed.

2. *Units expressed in equation 6-2 are inconsistent in the March 6, 1998, report. The unit for VF and PF should be in m^3/kg.*

   Response: The units have been corrected on pages 6-4 and 6-5. The proposed change pages are enclosed.

3. Henry's law constant H expressed in equation 5-5 should be denoted as H' to be consistent with Table 5-3.

   Response: The "prime" mark has been added in the equation to be consistent with Table 5-3. The proposed change page 5-12 is enclosed.

Comment 3: The response to our March 11, 1998 letter shall be incorporated into the final report, to demonstrate the conservative approach used in this project.

Response: Integrated is restating the comparative analysis conducted in response to RWQCB's March 11, 1998, review comments. This response to comments document should be included in the front matter of the post-demolition risk assessment. The calculated values for equation 5-12 have been corrected in accordance with RWQCB comment 1, above.

> March 11, 1998 RWQCB Comment 2: *Please use site-specific soil physical data (soil bulk density = 1.87 g/cm^3, water filled porosity = 0.37(-), and air filled porosity 0.06 (-)) to recalculate equations (5-1), (5-5), (5-11) and (5-12) for COPC tetrachloroethylene (Koc = 660 mL/g and H=0.957(-)), and tabulate the results in comparison with the current results in the report.*

Response: As presented in the subject document and in communications between Integrated and RWQCB staff, DTSC-HERD default soil parameters were used to conservatively estimate the rate of emissions from the site soils. Based on the use of these more conservative parameters, this approach ensures that the emissions estimated for the site are not underestimated. The following table has been assembled for the requested comparison (corrected in accordance with Comment 1 above):

Equation of Interest	**Site-Specific Soil Parameters**	**DTSC-HERD Soil Parameters**
5-1 Volatilization Factor (m^3/kg)	1.06E+04	3.02E+02
5-5 Soil-to-Air Partitioning Coefficient (g/cm^3)	3.60E-01	6.57E-01
5-11 Soil Gas Concentration (mg/L)	4.14E-06	7.51E-06
5-12 Vapor Flux (mg/cm^2-sec)	2.32E-15	7.32E-13

As shown in the comparison table, the DTSC-HERD values used in the risk assessment are significantly more conservative than the site-specific data for the estimation of emissions. As mentioned in communications with Water Board staff, the most sensitive equations to the parameters identified by the RWQCB are 5-4 and 5-13, the calculation of the chemical-specific effective diffusivity (Dei). The Dei estimated in the risk assessment represents a two-order-of magnitude higher estimated diffusion rate through the soils.

I appreciate the opportunity to work closely with you and your staff on this important project. Should you or your staff have any further questions concerning the Post-Demolition Risk Assessment, please feel free to call me directly at (714) 852-9050, extension 20.

Sincerely,

Chris Stoker
Program Manager

CC: S. Mario Stavale, Boeing

- Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual, Part A (EPA 1989a)
- Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 1 (EPA 1989b)
- Statistical Methods for Environmental Pollution Monitoring (Gilbert 1987)
- Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities (EPA 1989c)

For each soil COPC, statistical summaries were developed, including the arithmetic mean, standard error of the arithmetic mean, minimum measured concentration, maximum measured concentration, frequency of detection, D'Agostino's test and histograms for distribution, fit testing, and 95 percent upper confidence limit (UCL) of the mean (see Appendices C and D). The applicability of D'Agostino's test and the 95 percent UCL of the mean is discussed below. First, however, an approach for the assignment of values for non-detected results is addressed.

5.2.1 Treatment of Non-Detected Constituents

Every analytical technique used to measure the concentration of constituents has an associated limit of detection (LOD) and limit of quantification (LOQ). A constituent that was not detected in a sample is below the LOD. A constituent that was detected but in such low amounts that its concentration could not be accurately determined is below the LOQ. When a constituent is reported as not detected in a sample, the actual concentration is any value up to the LOD.

For this post-demolition risk assessment, when a constituent was found in some of the samples and was not clearly spatially limited, it is assumed to exist in samples in which it was not detected. The assignment of a value of one-half the detection limit (if the constituent is normally distributed), or the detection limit divided by the square root of 2 (if the constituent is lognormally distributed), or the LOD to all samples reported as not detected reflects the assumption that the samples are equally likely to have any value up to the detection limit. Furthermore, when the sample values above the LOQ are lognormally distributed, it is.

reasonable to assume that values below the LOQ are also lognormally distributed, and the reported detection limit divided by the square root of 2 should be assigned as a proxy value (Cal/EPA 1992, EPA 1988a, 1988b).

5.2.2 Determination of Data Distribution

The data set distribution must be determined prior to the application of any statistical methods. This minimizes the effect of data biasing. D'Agostino's test (Gilbert 1987) is an effective method for testing whether a data set has been drawn from an underlying normal distribution (see Appendix D). Conducting the test on the logarithms of the data is an equally effective way of evaluating the hypothesis of a lognormal distribution. Distribution histograms were developed when D'Agostino's test was found to be inconclusive. The data sets for the post-demolition risk assessment were found to best fit the lognormal distribution and were statistically evaluated in this manner.

5.2.3 Use of 95 Percent Upper Confidence Limit Concentrations

Due to the uncertainty associated with characterizing potentially heterogeneous media, the 95 percent UCL for either a normal or lognormal distribution must be used to represent constituent concentrations (Cal/EPA 1992, EPA 1988a, 1988b). As previously mentioned, the Parcel A data were determined to be lognormally distributed. Thus, the upper 95 percent UCL for lognormal distribution was used for soil source-term concentrations (see Appendix D).

Tables 5-1 and 5-2 summarize the 95 percent UCL concentrations for the soil COPCs by AOPC as calculated for direct exposures (0 to 12 feet bgs) and long-term fate and transport modeling (0 to 50 feet bgs). It is important to note that when the 95 percent UCL exceeded the maximum detected value, the maximum detected value was used. This approach is consistent with DTSC guidance (Cal/EPA 1994).

The values presented in Tables 5-1 and 5-2 are used throughout the post-demolition risk assessment.

$$D_{ei} = D_i \times (P_a^{3.33}/P_t^2) \qquad (5\text{-}4)$$

where

D_i = COPC-specific diffusivity of COPC in air (cm^2/sec), from Table 5-3

P_a = air filled porosity of soil matrix, 0.284 (unitless) (Cal/EPA 1994)

P_t = total porosity of soil matrix, 0.434 (unitless) (Cal/EPA 1994)

The soil-to-air partition coefficient, K_{as}, was derived from the COPC-specific soil-water partition coefficient and Henry's Law constant:

$$K_{as} = H'/(R \times T \times K_d) \qquad (5\text{-}5)$$

where

H' = COPC-specific Henry's Law constant (atm-m^3/mol), from Table 5-3

R = ideal gas constant, 8.206×10^{-5} atm-m^3/mol/K

T = temperature in Kelvin, 293 K

K_d = soil-to-water partitioning coefficient (cm^3/g), K_{oc} from Table 5-3 times the fraction of organic carbon (foc), 0.004 (unitless)

The intermediate conversion factor, Z, in the volatilization attenuation factor was calculated as:

$$Z = (D_{ei} \times P_a)/[P_a + (ps \times (1-P_a)/K_{as})] \qquad (5\text{-}6)$$

where

D_{ei} = effective diffusivity of a COPC through a soil matrix (cm^2/sec)

P_a = air filled porosity of the soil matrix, 0.284 (unitless) (Cal/EPA 1994)

ps = true soil or particle density, 1.5 g/cm^3 (Cal/EPA 1994)

K_{as} = soil-to-air partition coefficient (g soil/cm^3 air)

A summary of the calculated volatilization attenuation factors is presented in Table 5-4. .

maximum off-site impact for each COPC. Additional discrete receptor points have been located along the northern boundary of the residential development to the south of the Boeing property. These receptors have been used to estimate maximum off-site residential exposure concentrations. The flagpole receptor option in the ISCST3 model was used to place the grid points 1.5 meters above the ground—the approximate breathing height of a typical adult.

TABLE 5-5
COPC FLUX RATES BY SOURCE (mg/cm^2 sec)

COPC	AOPC 1	AOPC 2
1,1-dichloroethene	3.51E-11	8.75E-11
1,2,4-trimethylbenzene	3.68E-14	1.83E-13
1,3,5-trimethylbenzene	1.07E-13	3.18E-13
aroclor 1248	NV	NV
aroclor 1254	NV	NV
aroclor 1260	NV	NV
arsenic	NV	NV
benzo(a)anthracene	NV	NV
benzo(a)pyrene	NV	NV
benzo(b)fluoranthene	NV	NV
benzo(k)fluoranthene	NV	NV
bis(2-ethylhexyl)phthalate	NV	NV
chrysene	NV	NV
dibenzo(a,h)anthracene	NV	NV
fluoranthene	NV	NV
indeno(1,2,3-cd)pyrene	NV	NV
naphthalene	NV	NV
n-butylbenzene	4.77E-14	9.70E-14
n-propylbenzene	1.36E-13	3.12E-13
p-cymene	8.24E-15	1.80E-14
phenanthrene	NV	NV
pyrene	NV	NV
tetrachloroethylene	7.32E-13	1.06E-12
trichloroethene	8.74E-13	3.35E-12
xylenes	9.11E-14	1.91E-13

NV = Not Volatile

Air Dispersion Modeling Results

The ISCST3 results for the maximum on- and off-site COPC, concentrations in air are summarized in Table 5-6. The modeling output files are provided in Appendix A.

TABLE 5-6
MODELED MAXIMUM ON-SITE AND OFF-SITE COPC CONCENTRATIONS IN AIR (mg/m^3)

COPC	Maximum On-Site Concentration	Maximum Off-Site Concentration	Maximum Residential Concentration
1,1-dichloroethene	1.24E-05	6.57E-06	3.65E-08
1,2,4-trimethylbenzene	2.38E-08	7.04E-09	3.83E-11
1,3,5-trimethylbenzene	4.37E-08	2.01E-08	1.11E-10
aroclor 1248	NV	NV	NV
aroclor 1254	NV	NV	NV
aroclor 1260	NV	NV	NV
arsenic	NV	NV	NV
benzo(a)anthracene	NV	NV	NV
benzo(a)pyrene	NV	NV	NV
benzo(b)fluoranthene	NV	NV	NV
benzo(k)fluoranthene	NV	NV	NV
bis(2-ethylhexyl)phthalate	NV	NV	NV
chrysene	NV	NV	NV
dibenzo(a,h)anthracene	NV	NV	NV
fluoranthene	NV	NV	NV
indeno(1,2,3-cd)pyrene	NV	NV	NV
naphthalene	NV	NV	NV
n-butylbenzene	1.43E-08	8.90E-09	4.96E-11
n-propylbenzene	4.48E-08	2.54E-08	1.41E-10
p-cymene	2.61E-09	1.54E-09	8.57E-12
phenanthrene	NV	NV	NV
pyrene	NV	NV	NV
tetrachloroethylene	1.70E-07	1.36E-07	7.61E-10
trichloroethene	4.46E-07	1.66E-07	9.09E-10
xylenes	2.79E-08	1.70E-08	9.47E-11

NV = Not Volatile

The exposure pathways of concern for the construction worker are: 1) inhalation of VOCs and particulate, 2) incidental ingestion of soil, and 3) dermal contact with soil. The example calculation methodology applies to all receptors associated with the Parcel A exposure scenarios; however, appropriate exposure parameters for other receptors would be substituted where applicable.

6.1.1 Air Exposures - Inhalation

Equation 6-16 from RAGS (EPA 1989a) was used to quantify intake from the inhalation pathway:

$$I_a = (C_a)(IR)(ET)(EF)(ED) / (BW)(AT) \quad (6\text{-}1)$$

where

I_a	=	intake from inhalation of a COPC in air (mg/kg-d)
C_a	=	concentration of COPC in air (mg/m^3)
IR	=	inhalation rate (m^3/h)
ET	=	exposure time (h/d)
EF	=	exposure frequency (d/y)
ED	=	exposure duration (y)
BW	=	body weight (kg)
AT	=	averaging time (d), ED x 365d/y (noncarcinogens), 70y x 365d/y (carcinogens)

The COPC concentration in air, C_a, was calculated separately for the construction and commercial/industrial emissions cases, as follows:

Construction Emissions Case

$$C_a = (C_s)(1/VF + 1/PF) \quad (6\text{-}2)$$

C_s	=	concentration of COPC in soil (mg/kg), from Table 5-1
VF	=	volatilization factor (m^3/kg), from Table 5-4

PF = particulate attenuation factor, 4.77×10^9 $\underline{\underline{m^3/kg}}$

Commercial/Industrial Emissions Case

$$C_a = C_i + C_o \qquad (6\text{-}3)$$

C_i = modeled indoor air concentration (mg/m^3), from Table 5-7

C_o = maximum modeled on-site COPC concentration (mg/m^3), from Table 5-6

As mentioned, the on-site construction worker's exposure to benzene is used as an example. The construction worker's intake (I_a) resulting from inhaling air hypothetically containing 1 milligram benzene per cubic meter air (C_a) is calculated as follows (see Table 6-1 for exposure parameters and sources). The inhalation rate (IR) for an active adult is 2.5 cubic meters per hour. The total exposure time (ET) is 8 hours per day for on-site exposures. The exposure duration (ED) is 1 year, and the exposure frequency (EF) is 250 days per year. The body weight (BW) for the adult resident is 70 kilograms. Since benzene is a carcinogen, the exposure is averaged over a 70-year lifetime (AT = 25,550 d). The exposure would be averaged over the period of exposure for all noncarcinogenic exposures (AT = ED x 365). Substituting these values into Equation 6-1 yields:

$$I_a = (1.0\ mg/m^3)(2.5\ m^3/h)(8\ h/d)(250\ d/y)(1\ y)\ /\ (70kg)(25550\ d) \qquad (6\text{-}4)$$

or

$$I_a = 2.80 \times 10^{-3}\ mg/kg\text{-}d$$

Appendix B presents the complete calculation sheets for inhalation exposures.

1.1.1 Soil Exposures - Incidental Ingestion

Equation 6-14 from RAGS (EPA 1989a) was used to quantify intake from the ingestion pathway:

6.3 RISKS POSED BY THE POST-DEMOLITION EXPOSURE SCENARIOS

Table 6-3 presents the total HI and total ILCR results for each AOPC and receptor studied under the Parcel A post-demolition exposure scenarios. Because the reasonable maximum exposure (RME) approach was used to quantify potential health impacts, it should be noted that if the estimated health effects of the RME are within acceptable limits, then it is likely that all other, lesser exposures related to Parcel A are also within these limits. See Section 4.1.3 for more information on RME.

Each entry in the Table 6-3 is supported by detailed calculations of health effects by receptor, COPC, and pathway (see Appendix B).

**TABLE 6-3
SUMMARY OF POST-DEMOLITION HEALTH RISK,
C-6 FACILITY, PARCEL A**

On-Site Receptors	HI	ILCR
AOPC 1		
Construction Worker	5.1E-02	1.4E-06
Commercial/Industrial Worker, RME[a]	6.4E-05	1.2E-10
Commercial/Industrial Worker, Upper Bound[b]	4.6E-03	4.4E-06
AOPC 2		
Construction Worker	1.5E-02	7.7E-07
Commercial/Industrial Worker, RME[a]	8.7E-05	1.7E-10
Commercial/Industrial Worker, Upper Bound[b]	1.0E-03	2.5E-06
Off-Site Receptors	**HI**	**ILCR**
Commercial/Industrial Worker	2.5E-05	5.2E-11
Resident Adult	1.2E-06	2.9E-12
Resident Child	5.5E-06	2.7E-12

NOTES:
[a]Reasonable Maximum Exposure conditions, assumes 2-foot layer of clean fill.
[b]Upper Bound exposure conditions, assumes no layer of fill.

AOPC = Area of Potential Concern
HI = Hazard Index
ILCR = Incremental Lifetime Cancer Risk

Table B-1
Summary of Potential Health Effects
On-Site Construction Worker AOPC 1

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Particulates and Volatiles	3.5E-03
Incidental ingestion of soils	3.1E-02
Dermal contact with soils	1.7E-02
Total Population Hazard Quotient =	5.1E-02

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Particulates and Volatiles	8.1E-10
Incidental ingestion of soils	6.0E-07
Dermal contact with soils	8.2E-07
Total Population Incremental Lifetime Cancer Risk =	1.4E-06

Table B-2
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Incidental Ingestion of Soils

Intake Equation = $\frac{CS \times EF \times ED \times CF \times IR}{BW \times AT}$

IRs	Ingestion rate of soil (RAGS, 1989)	480	mg/day
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	250	d/year
EDn	Exposure duration for non-carcinogens	1	year
EDc	Exposure duration for carcinogens	1	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	365	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	Concentration
1,1-dichloroethene	2.57E-03
1,2,4-trimethylbenzene	3.82E-03
1,3,5-trimethylbenzene	2.96E-03
aroclor 1248	3.69E-02
aroclor 1254	3.28E-02
aroclor 1260	2.08E-02
arsenic	1.56E+00
benzo(a)anthracene	2.43E-01
benzo(a)pyrene	3.39E-01
benzo(b)fluoranthene	3.91E-01
benzo(k)fluoranthene	3.06E-01
bis(2-ethylhexyl)phthalate	2.58E-01
chrysene	2.86E-01
dibenzo(a,h)anthracene	1.36E-01
fluoranthene	2.66E-01
indeno(1,2,3-cd)pyrene	3.33E-01

Compound	Concentration
naphthalene	2.05E-01
n-butylbenzene	2.81E-03
n-propylbenzene	2.57E-03
p-cymene	2.47E-03
phenanthrene	2.03E-01
pyrene	3.12E-01
tetrachloroethene	2.69E-03
trichloroethene	2.63E-03
xylenes	2.34E-03

Table B-2 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Incidental Ingestion of Soils

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	1.21E-08	9.00E-03	1.34E-06
1,2,4-trimethylbenzene	1.79E-08	5.00E-01	3.59E-08
1,3,5-trimethylbenzene	1.39E-08	5.00E-01	2.78E-08
aroclor 1248	1.73E-07	7.00E-05	2.48E-03
aroclor 1254	1.54E-07	7.00E-05	2.20E-03
aroclor 1260	9.77E-08	7.00E-05	1.40E-03
arsenic	7.33E-06	3.00E-04	2.44E-02
benzo(a)anthracene	1.14E-06	4.00E-02	2.85E-05
benzo(a)pyrene	1.59E-06	4.00E-02	3.98E-05
benzo(b)fluoranthene	1.84E-06	4.00E-02	4.59E-05
benzo(k)fluoranthene	1.44E-06	4.00E-02	3.59E-05
bis(2-ethylhexyl)phthalate	1.21E-06	2.00E-02	6.06E-05
chrysene	1.34E-06	4.00E-02	3.36E-05
dibenzo(a,h)anthracene	6.39E-07	4.00E-02	1.60E-05
fluoranthene	1.25E-06	4.00E-01	3.12E-06
indeno(1,2,3-cd)pyrene	1.56E-06	4.00E-02	3.91E-05
naphthalene	9.63E-07	4.00E-02	2.41E-05
n-butylbenzene	1.32E-08	1.00E-01	1.32E-07
n-propylbenzene	1.21E-08	1.00E-01	1.21E-07
p-cymene	1.16E-08	1.00E-01	1.16E-07
phenanthrene	9.53E-07	3.00E-01	3.18E-06
pyrene	1.47E-06	3.00E-01	4.88E-06
tetrachloroethene	1.26E-08	1.00E-01	1.26E-07
trichloroethene	1.24E-08	7.35E-03	1.68E-06
xylenes	1.10E-08	2.00E+00	5.50E-09
	HQ Summation =		3.1E-02

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	1.72E-10	NA	NA
1,2,4-trimethylbenzene	2.56E-10	NA	NA
1,3,5-trimethylbenzene	1.99E-10	NA	NA
aroclor 1248	2.48E-09	7.70E+00	1.91E-08
aroclor 1254	2.20E-09	7.70E+00	1.69E-08
aroclor 1260	1.40E-09	7.70E+00	1.07E-08
arsenic	1.05E-07	1.50E+00	1.57E-07
benzo(a)anthracene	1.63E-08	1.15E+00	1.87E-08
benzo(a)pyrene	2.27E-08	1.15E+01	2.62E-07
benzo(b)fluoranthene	2.62E-08	1.15E+00	3.02E-08
benzo(k)fluoranthene	2.05E-08	1.15E+00	2.36E-08
bis(2-ethylhexyl)phthalate	1.73E-08	8.40E-03	1.45E-10
chrysene	1.92E-08	1.15E-01	2.21E-09
dibenzo(a,h)anthracene	9.12E-09	4.10E+00	3.74E-08
fluoranthene	1.78E-08	NA	NA
indeno(1,2,3-cd)pyrene	2.23E-08	1.15E+00	2.57E-08
naphthalene	1.38E-08	NA	NA
n-butylbenzene	1.89E-10	NA	NA
n-propylbenzene	1.72E-10	NA	NA
p-cymene	1.66E-10	NA	NA
phenanthrene	1.36E-08	NA	NA
pyrene	2.09E-08	NA	NA
tetrachloroethene	1.80E-10	5.10E-02	9.20E-12
trichloroethene	1.76E-10	1.50E-02	2.65E-12
xylenes	1.57E-10	NA	NA
	ILCR Summation =		6.0E-07

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Table B-3
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Dermal Contact with Soils

Intake Equation =

$$\frac{CS \times CF \times EF \times ED \times AF \times ABS \times SA}{BW \times AT}$$

SA	Surface area of exposed skin (50th percentile, hands only)	5800	cm^2/day
AF	Adherence Factor	1	mg/cm^2
ABS	Absorption factor (see table below)	csv	
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	250	d/year
EDn	Exposure duration for non-carcinogens	1	year
EDc	Exposure duration for carcinogens	1	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	365	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	ABS (unitless)	Concentration (mg/kg)
1,1-dichloroethene	1.00E-01	2.57E-03
1,2,4-trimethylbenzene	1.00E-01	3.82E-03
1,3,5-trimethylbenzene	1.00E-01	2.96E-03
aroclor 1248	1.00E-01	3.69E-02
aroclor 1254	1.00E-01	3.28E-02
aroclor 1260	1.00E-01	2.08E-02
arsenic	3.00E-02	1.56E+00
benzo(a)anthracene	1.50E-01	2.43E-01
benzo(a)pyrene	1.50E-01	3.39E-01
benzo(b)fluoranthene	1.50E-01	3.91E-01
benzo(k)fluoranthene	1.50E-01	3.06E-01
bis(2-ethylhexyl)phthalate	1.00E-01	2.58E-01
chrysene	1.50E-01	2.86E-01
dibenzo(a,h)anthracene	1.50E-01	1.36E-01
fluoranthene	1.00E-01	2.66E-01
indeno(1,2,3-cd)pyrene	1.00E-01	3.33E-01

Compound	ABS (unitless)	Concentration (mg/kg)
naphthalene	1.50E-01	2.05E-01
n-butylbenzene	1.00E-01	2.81E-03
n-propylbenzene	1.00E-01	2.57E-03
p-cymene	1.00E-01	2.47E-03
phenanthrene	1.50E-01	2.03E-01
pyrene	1.50E-01	3.12E-01
tetrachloroethene	1.00E-01	2.69E-03
trichloroethene	1.00E-01	2.63E-03
xylenes	1.00E-01	2.34E-03

Table B-3 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Dermal Contact with Soils

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	1.46E-08	9.00E-03	1.62E-06
1,2,4-trimethylbenzene	2.17E-08	5.00E-01	4.34E-08
1,3,5-trimethylbenzene	1.68E-08	5.00E-01	3.36E-08
aroclor 1248	2.09E-07	7.00E-05	2.99E-03
aroclor 1254	1.86E-07	7.00E-05	2.66E-03
aroclor 1260	1.18E-07	7.00E-05	1.69E-03
arsenic	2.66E-06	3.00E-04	8.85E-03
benzo(a)anthracene	2.07E-06	4.00E-02	5.17E-05
benzo(a)pyrene	2.89E-06	4.00E-02	7.21E-05
benzo(b)fluoranthene	3.33E-06	4.00E-02	8.32E-05
benzo(k)fluoranthene	2.60E-06	4.00E-02	6.51E-05
bis(2-ethylhexyl)phthalate	1.46E-06	2.00E-02	7.32E-05
chrysene	2.43E-06	4.00E-02	6.09E-05
dibenzo(a,h)anthracene	1.16E-06	4.00E-02	2.89E-05
fluoranthene	1.51E-06	4.00E-01	3.77E-06
indeno(1,2,3-cd)pyrene	1.89E-06	4.00E-02	4.72E-05
naphthalene	1.75E-06	4.00E-02	4.36E-05
n-butylbenzene	1.59E-08	1.00E-01	1.59E-07
n-propylbenzene	1.46E-08	1.00E-01	1.46E-07
p-cymene	1.40E-08	1.00E-01	1.40E-07
phenanthrene	1.73E-06	3.00E-01	5.76E-06
pyrene	2.66E-06	3.00E-01	8.85E-06
tetrachloroethene	1.53E-08	1.00E-01	1.53E-07
trichloroethene	1.49E-08	7.35E-03	2.03E-06
xylenes	1.33E-08	2.00E+00	6.64E-09
	HQ Summation =		1.7E-02

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	2.08E-10	NA	NA
1,2,4-trimethylbenzene	3.10E-10	NA	NA
1,3,5-trimethylbenzene	2.40E-10	NA	NA
aroclor 1248	2.99E-09	7.70E+00	2.30E-08
aroclor 1254	2.66E-09	7.70E+00	2.05E-08
aroclor 1260	1.69E-09	7.70E+00	1.30E-08
arsenic	3.79E-08	1.50E+00	5.69E-08
benzo(a)anthracene	2.96E-08	1.15E+00	3.40E-08
benzo(a)pyrene	4.12E-08	1.15E+01	4.74E-07
benzo(b)fluoranthene	4.75E-08	1.15E+00	5.47E-08
benzo(k)fluoranthene	3.72E-08	1.15E+00	4.28E-08
bis(2-ethylhexyl)phthalate	2.09E-08	8.40E-03	1.76E-10
chrysene	3.48E-08	1.15E-01	4.00E-09
dibenzo(a,h)anthracene	1.65E-08	4.10E+00	6.78E-08
fluoranthene	2.16E-08	NA	NA
indeno(1,2,3-cd)pyrene	2.70E-08	1.15E+00	3.10E-08
naphthalene	2.49E-08	NA	NA
n-butylbenzene	2.28E-10	NA	NA
n-propylbenzene	2.08E-10	NA	NA
p-cymene	2.00E-10	NA	NA
phenanthrene	2.47E-08	NA	NA
pyrene	3.79E-08	NA	NA
tetrachloroethene	2.18E-10	5.10E-02	1.11E-11
trichloroethene	2.13E-10	1.50E-02	3.20E-12
xylenes	1.90E-10	NA	NA
	ILCR Summation =		8.2E-07

Table B-4
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Inhalation of Particulates and Volatiles

Intake Equation = $\frac{CS \times (1/VF + 1/PEF) \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	2.5 m^3/h
EF	Exposure frequency	250 days/year
EDn	Exposure duration for non-carcinogens	1 year
EDc	Exposure duration for carcinogens	1 year
BW	Body weight	70 kg
ATc	Average time for carcinogens (lifetime)	25550 days
ATn	Average time for non-carcinogens (EDn x 365)	365 days
ET	Exposure tim outdoors	8 h/d
CS	Concentration of chemicals in soil	(see Table 5-1)
VF	Volatilization Factor	(see Table 5-4)
PEF	Particulate Emission Factor	(see Section 5.3.1.2)

Chemical Concentrations

Compound	VF (m3/kg)	PEF (m3/kg)	Cs (mg/kg)
1,1-dichloroethene	2.07E+01	NA	2.57E-03
1,2,4-trimethylbenzene	1.79E+03	NA	3.82E-03
1,3,5-trimethylbenzene	8.99E+02	NA	2.96E-03
aroclor 1248	NA	4.77E+09	3.69E-02
aroclor 1254	NA	4.77E+09	3.28E-02
aroclor 1260	NA	4.77E+09	2.08E-02
arsenic	NA	4.77E+09	1.56E+00
benzo(a)anthracene	NA	4.77E+09	2.43E-01
benzo(a)pyrene	NA	4.77E+09	3.39E-01
benzo(b)fluoranthene	NA	4.77E+09	3.91E-01
benzo(k)fluoranthene	NA	4.77E+09	3.06E-01
bis(2-ethylhexyl)phthalate	NA	4.77E+09	2.58E-01
chrysene	NA	4.77E+09	2.86E-01
dibenzo(a,h)anthracene	NA	4.77E+09	1.36E-01
fluoranthene	NA	4.77E+09	2.66E-01
indeno(1,2,3-cd)pyrene	NA	4.77E+09	3.33E-01

Compound	VF (m3/kg)	PEF (m3/kg)	Cs (mg/kg)
naphthalene	NA	4.77E+09	2.05E-01
n-butylbenzene	1.26E+03	NA	2.81E-03
n-propylbenzene	7.29E+02	NA	2.57E-03
p-cymene	2.94E+03	NA	2.47E-03
phenanthrene	NA	4.77E+09	2.03E-01
pyrene	NA	4.77E+09	3.12E-01
tetrachloroethene	3.02E+02	NA	2.69E-03
trichloroethene	2.72E+02	NA	2.63E-03
xylenes	8.50E+02	NA	2.34E-03

Table B-4 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 1
Via Inhalation of Particulates and Volatiles

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.43E-05	9.00E-03	2.70E-03
1,2,4-trimethylbenzene	4.18E-07	2.00E-03	2.09E-04
1,3,5-trimethylbenzene	6.44E-07	2.00E-03	3.22E-04
aroclor 1248	1.51E-12	7.00E-05	2.16E-08
aroclor 1254	1.34E-12	7.00E-05	1.92E-08
aroclor 1260	8.53E-13	7.00E-05	1.22E-08
arsenic	6.39E-11	3.00E-04	2.13E-07
benzo(a)anthracene	9.96E-12	4.00E-02	2.49E-10
benzo(a)pyrene	1.39E-11	4.00E-02	3.47E-10
benzo(b)fluoranthene	1.60E-11	4.00E-02	4.01E-10
benzo(k)fluoranthene	1.25E-11	4.00E-02	3.14E-10
bis(2-ethylhexyl)phthalate	1.06E-11	2.00E-02	5.29E-10
chrysene	1.17E-11	4.00E-02	2.93E-10
dibenzo(a,h)anthracene	5.57E-12	4.00E-02	1.39E-10
fluoranthene	1.09E-11	4.00E-01	2.73E-11
indeno(1,2,3-cd)pyrene	1.36E-11	4.00E-02	3.41E-10
naphthalene	8.40E-12	4.00E-02	2.10E-10
n-butylbenzene	4.38E-07	2.90E-01	1.51E-06
n-propylbenzene	6.90E-07	2.90E-01	2.38E-06
p-cymene	1.64E-07	1.00E-01	1.64E-06
phenanthrene	8.32E-12	3.00E-01	2.77E-11
pyrene	1.28E-11	3.00E-01	4.26E-11
tetrachloroethene	1.74E-06	1.00E-01	1.74E-05
trichloroethene	1.89E-06	7.35E-03	2.58E-04
xylenes	5.39E-07	2.00E-01	2.69E-06
	HQ Summation =		3.5E-03

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)$^{-1}$	ILCR (unitless)
1,1-dichloroethene	3.47E-07	NA	NA
1,2,4-trimethylbenzene	5.97E-09	NA	NA
1,3,5-trimethylbenzene	9.21E-09	NA	NA
aroclor 1248	2.16E-14	7.70E+00	1.66E-13
aroclor 1254	1.92E-14	7.70E+00	1.48E-13
aroclor 1260	1.22E-14	7.70E+00	9.38E-14
arsenic	9.13E-13	1.20E+01	1.10E-11
benzo(a)anthracene	1.42E-13	3.90E-01	5.55E-14
benzo(a)pyrene	1.99E-13	3.90E+00	7.74E-13
benzo(b)fluoranthene	2.29E-13	3.90E-01	8.93E-14
benzo(k)fluoranthene	1.79E-13	3.90E-01	6.99E-14
bis(2-ethylhexyl)phthalate	1.51E-13	8.40E-03	1.27E-15
chrysene	1.67E-13	3.90E-02	6.53E-15
dibenzo(a,h)anthracene	7.96E-14	4.10E+00	3.27E-13
fluoranthene	1.56E-13	NA	NA
indeno(1,2,3-cd)pyrene	1.95E-13	3.90E-01	7.60E-14
naphthalene	1.20E-13	NA	NA
n-butylbenzene	6.26E-09	NA	NA
n-propylbenzene	9.85E-09	NA	NA
p-cymene	2.35E-09	NA	NA
phenanthrene	1.19E-13	NA	NA
pyrene	1.83E-13	NA	NA
tetrachloroethene	2.49E-08	2.10E-02	5.22E-10
trichloroethene	2.71E-08	1.00E-02	2.71E-10
xylenes	7.70E-09	NA	NA
	ILCR Summation =		8.1E-10

Table B-5
Summary of Potential Health Effects
On-Site Construction Worker AOPC 2

Exposure Pathway	**Receptor Hazard Quotient**
Inhalation of Particulates and Volatiles	7.1E-03
Incidental ingestion of soils	3.5E-03
Dermal contact with soils	4.4E-03
Total Population Hazard Quotient =	1.5E-02

Exposure Pathway	**Receptor Incremental Lifetime Cancer Risk**
Inhalation of Particulates and Volatiles	1.8E-09
Incidental ingestion of soils	2.8E-07
Dermal contact with soils	4.8E-07
Total Population Incremental Lifetime Cancer Risk =	7.7E-07

Table B-6
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Incidental Ingestion of Soils

Intake Equation = $\frac{CS \times EF \times ED \times CF \times IR}{BW \times AT}$

IRs	Ingestion rate of soil (RAGS, 1989)	480	mg/day
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	250	d/year
EDn	Exposure duration for non-carcinogens	1	year
EDc	Exposure duration for carcinogens	1	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	365	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	Concentration
1,1-dichloroethene	4.05E-03
1,2,4-trimethylbenzene	1.85E-02
1,3,5-trimethylbenzene	8.93E-03
aroclor 1248	1.63E-02
aroclor 1254	1.63E-02
aroclor 1260	1.72E-02
arsenic	NA
benzo(a)anthracene	1.06E-01
benzo(a)pyrene	2.24E-01
benzo(b)fluoranthene	2.28E-01
benzo(k)fluoranthene	2.05E-01
bis(2-ethylhexyl)phthalate	1.03E-01
chrysene	1.22E-01
dibenzo(a,h)anthracene	8.54E-02
fluoranthene	1.18E-01
indeno(1,2,3-cd)pyrene	2.12E-01

Compound	Concentration
naphthalene	2.15E-01
n-butylbenzene	6.18E-03
n-propylbenzene	5.78E-03
p-cymene	6.45E-03
phenanthrene	1.42E-01
pyrene	1.28E-01
tetrachloroethene	4.53E-03
trichloroethene	8.56E-03
xylenes	6.45E-03

Table B-6 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Incidental Ingestion of Soils

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	1.90E-08	9.00E-03	2.11E-06
1,2,4-trimethylbenzene	8.69E-08	5.00E-01	1.74E-07
1,3,5-trimethylbenzene	4.19E-08	5.00E-01	8.39E-08
aroclor 1248	7.66E-08	7.00E-05	1.09E-03
aroclor 1254	7.66E-08	7.00E-05	1.09E-03
aroclor 1260	8.08E-08	7.00E-05	1.15E-03
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	4.98E-07	4.00E-02	1.24E-05
benzo(a)pyrene	1.05E-06	4.00E-02	2.63E-05
benzo(b)fluoranthene	1.07E-06	4.00E-02	2.68E-05
benzo(k)fluoranthene	9.63E-07	4.00E-02	2.41E-05
bis(2-ethylhexyl)phthalate	4.84E-07	2.00E-02	2.42E-05
chrysene	5.73E-07	4.00E-02	1.43E-05
dibenzo(a,h)anthracene	4.01E-07	4.00E-02	1.00E-05
fluoranthene	5.54E-07	4.00E-01	1.39E-06
indeno(1,2,3-cd)pyrene	9.96E-07	4.00E-02	2.49E-05
naphthalene	1.01E-06	4.00E-02	2.52E-05
n-butylbenzene	2.90E-08	1.00E-01	2.90E-07
n-propylbenzene	2.71E-08	1.00E-01	2.71E-07
p-cymene	3.03E-08	1.00E-01	3.03E-07
phenanthrene	6.67E-07	3.00E-01	2.22E-06
pyrene	6.01E-07	3.00E-01	2.00E-06
tetrachloroethene	2.13E-08	1.00E-01	2.13E-07
trichloroethene	4.02E-08	7.35E-03	5.47E-06
xylenes	3.03E-08	2.00E+00	1.51E-08
	HQ Summation =		3.5E-03

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	2.72E-10	NA	NA
1,2,4-trimethylbenzene	1.24E-09	NA	NA
1,3,5-trimethylbenzene	5.99E-10	NA	NA
aroclor 1248	1.09E-09	7.70E+00	8.42E-09
aroclor 1254	1.09E-09	7.70E+00	8.42E-09
aroclor 1260	1.15E-09	7.70E+00	8.89E-09
arsenic	NA	1.50E+00	NA
benzo(a)anthracene	7.11E-09	1.15E+00	8.18E-09
benzo(a)pyrene	1.50E-08	1.15E+01	1.73E-07
benzo(b)fluoranthene	1.53E-08	1.15E+00	1.76E-08
benzo(k)fluoranthene	1.38E-08	1.15E+00	1.58E-08
bis(2-ethylhexyl)phthalate	6.91E-09	8.40E-03	5.81E-11
chrysene	8.19E-09	1.15E-01	9.41E-10
dibenzo(a,h)anthracene	5.73E-09	4.10E+00	2.35E-08
fluoranthene	7.92E-09	NA	NA
indeno(1,2,3-cd)pyrene	1.42E-08	1.15E+00	1.64E-08
naphthalene	1.44E-08	NA	NA
n-butylbenzene	4.15E-10	NA	NA
n-propylbenzene	3.88E-10	NA	NA
p-cymene	4.33E-10	NA	NA
phenanthrene	9.53E-09	NA	NA
pyrene	8.59E-09	NA	NA
tetrachloroethene	3.04E-10	5.10E-02	1.55E-11
trichloroethene	5.74E-10	1.50E-02	8.62E-12
xylenes	4.33E-10	NA	NA
	ILCR Summation =		2.8E-07

Table B-7
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Dermal Contact with Soils

Intake Equation $= \dfrac{CS \times CF \times EF \times ED \times AF \times ABS \times SA}{BW \times AT}$

SA	Surface area of exposed skin (50th percentile, hands only)	5800	cm^2/day
AF	Adherence Factor	1	mg/cm^2
ABS	Absorption factor (see table below)	csv	
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	250	d/year
EDn	Exposure duration for non-carcinogens	1	year
EDc	Exposure duration for carcinogens	1	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	365	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	ABS (unitless)	Concentration (mg/kg)
1,1-dichloroethene	1.00E-01	4.05E-03
1,2,4-trimethylbenzene	1.00E-01	1.85E-02
1,3,5-trimethylbenzene	1.00E-01	8.93E-03
aroclor 1248	1.00E-01	1.63E-02
aroclor 1254	1.00E-01	1.63E-02
aroclor 1260	1.00E-01	1.72E-02
arsenic	3.00E-02	NA
benzo(a)anthracene	1.50E-01	1.06E-01
benzo(a)pyrene	1.50E-01	2.24E-01
benzo(b)fluoranthene	1.50E-01	2.28E-01
benzo(k)fluoranthene	1.50E-01	2.05E-01
bis(2-ethylhexyl)phthalate	1.00E-01	1.03E-01
chrysene	1.50E-01	1.22E-01
dibenzo(a,h)anthracene	1.50E-01	8.54E-02
fluoranthene	1.00E-01	1.18E-01
indeno(1,2,3-cd)pyrene	1.00E-01	2.12E-01

Compound	ABS (unitless)	Concentration (mg/kg)
naphthalene	1.50E-01	2.15E-01
n-butylbenzene	1.00E-01	6.18E-03
n-propylbenzene	1.00E-01	5.78E-03
p-cymene	1.00E-01	6.45E-03
phenanthrene	1.50E-01	1.42E-01
pyrene	1.50E-01	1.28E-01
tetrachloroethene	1.00E-01	4.53E-03
trichloroethene	1.00E-01	8.56E-03
xylenes	1.00E-01	6.45E-03

Table B-7 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Dermal Contact with Soils

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.30E-08	9.00E-03	2.55E-06
1,2,4-trimethylbenzene	1.05E-07	5.00E-01	2.10E-07
1,3,5-trimethylbenzene	5.07E-08	5.00E-01	1.01E-07
aroclor 1248	9.25E-08	7.00E-05	1.32E-03
aroclor 1254	9.25E-08	7.00E-05	1.32E-03
aroclor 1260	9.76E-08	7.00E-05	1.39E-03
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	9.02E-07	4.00E-02	2.26E-05
benzo(a)pyrene	1.91E-06	4.00E-02	4.77E-05
benzo(b)fluoranthene	1.94E-06	4.00E-02	4.85E-05
benzo(k)fluoranthene	1.75E-06	4.00E-02	4.36E-05
bis(2-ethylhexyl)phthalate	5.85E-07	2.00E-02	2.92E-05
chrysene	1.04E-06	4.00E-02	2.60E-05
dibenzo(a,h)anthracene	7.27E-07	4.00E-02	1.82E-05
fluoranthene	6.70E-07	4.00E-01	1.67E-06
indeno(1,2,3-cd)pyrene	1.20E-06	4.00E-02	3.01E-05
naphthalene	1.83E-06	4.00E-02	4.58E-05
n-butylbenzene	3.51E-08	1.00E-01	3.51E-07
n-propylbenzene	3.28E-08	1.00E-01	3.28E-07
p-cymene	3.66E-08	1.00E-01	3.66E-07
phenanthrene	1.21E-06	3.00E-01	4.03E-06
pyrene	1.09E-06	3.00E-01	3.63E-06
tetrachloroethene	2.57E-08	1.00E-01	2.57E-07
trichloroethene	4.86E-08	7.35E-03	6.61E-06
xylenes	3.66E-08	2.00E+00	1.83E-08
	HQ Summation =		4.4E-03

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	3.28E-10	NA	NA
1,2,4-trimethylbenzene	1.50E-09	NA	NA
1,3,5-trimethylbenzene	7.24E-10	NA	NA
aroclor 1248	1.32E-09	7.70E+00	1.02E-08
aroclor 1254	1.32E-09	7.70E+00	1.02E-08
aroclor 1260	1.39E-09	7.70E+00	1.07E-08
arsenic	NA	1.50E+00	NA
benzo(a)anthracene	1.29E-08	1.15E+00	1.48E-08
benzo(a)pyrene	2.72E-08	1.15E+01	3.13E-07
benzo(b)fluoranthene	2.77E-08	1.15E+00	3.19E-08
benzo(k)fluoranthene	2.49E-08	1.15E+00	2.87E-08
bis(2-ethylhexyl)phthalate	8.35E-09	8.40E-03	7.01E-11
chrysene	1.48E-08	1.15E-01	1.71E-09
dibenzo(a,h)anthracene	1.04E-08	4.10E+00	4.26E-08
fluoranthene	9.57E-09	NA	NA
indeno(1,2,3-cd)pyrene	1.72E-08	1.15E+00	1.98E-08
naphthalene	2.61E-08	NA	NA
n-butylbenzene	5.01E-10	NA	NA
n-propylbenzene	4.69E-10	NA	NA
p-cymene	5.23E-10	NA	NA
phenanthrene	1.73E-08	NA	NA
pyrene	1.56E-08	NA	NA
tetrachloroethene	3.67E-10	5.10E-02	1.87E-11
trichloroethene	6.94E-10	1.50E-02	1.04E-11
xylenes	5.23E-10	NA	NA
	ILCR Summation =		4.8E-07

Table B-8
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Inhalation of Particulates and Volatiles

Intake Equation =

$$\frac{CS \times (1/VF + 1/PEF) \times EF \times ED \times ET \times IR}{BW \times AT}$$

IR	Inhalation rate of gases (RAGS, 1989)	2.5	m3/h
EF	Exposure frequency	250	days/year
EDn	Exposure duration for non-carcinogens	1	year
EDc	Exposure duration for carcinogens	1	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	365	days
ET	Exposure tim outdoors	8	h/d
CS	Concentration of chemicals in soil	(see Table 5-1)	
VF	Volatilization Factor	(see Table 5-4)	
PEF	Particulate Emission Factor	(see Section 5.3.1.2)	

Chemical Concentrations

Compound	VF (m3/kg)	PEF (m3/kg)	Cs (mg/kg)
1,1-dichloroethene	2.07E+01	NA	4.05E-03
1,2,4-trimethylbenzene	1.79E+03	NA	1.85E-02
1,3,5-trimethylbenzene	8.99E+02	NA	8.93E-03
aroclor 1248	NA	4.77E+09	1.63E-02
aroclor 1254	NA	4.77E+09	1.63E-02
aroclor 1260	NA	4.77E+09	1.72E-02
arsenic	NA	4.77E+09	NA
benzo(a)anthracene	NA	4.77E+09	1.06E-01
benzo(a)pyrene	NA	4.77E+09	2.24E-01
benzo(b)fluoranthene	NA	4.77E+09	2.28E-01
benzo(k)fluoranthene	NA	4.77E+09	2.05E-01
bis(2-ethylhexyl)phthalate	NA	4.77E+09	1.03E-01
chrysene	NA	4.77E+09	1.22E-01
dibenzo(a,h)anthracene	NA	4.77E+09	8.54E-02
fluoranthene	NA	4.77E+09	1.18E-01
indeno(1,2,3-cd)pyrene	NA	4.77E+09	2.12E-01

Compound	VF (m3/kg)	PEF (m3/kg)	Cs (mg/kg)
naphthalene	NA	4.77E+09	2.15E-01
n-butylbenzene	1.26E+03	NA	6.18E-03
n-propylbenzene	7.29E+02	NA	5.78E-03
p-cymene	2.94E+03	NA	6.45E-03
phenanthrene	NA	4.77E+09	1.42E-01
pyrene	NA	4.77E+09	1.28E-01
tetrachloroethene	3.02E+02	NA	4.53E-03
trichloroethene	2.72E+02	NA	8.56E-03
xylenes	8.50E+02	NA	6.45E-03

Table B-8 (cont.)
Summary of Unit Risk Characterization
On-Site Construction Worker AOPC 2
Via Inhalation of Particulates and Volatiles

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	3.83E-05	9.00E-03	4.26E-03
1,2,4-trimethylbenzene	2.02E-06	2.00E-03	1.01E-03
1,3,5-trimethylbenzene	1.94E-06	2.00E-03	9.72E-04
aroclor 1248	6.68E-13	7.00E-05	9.54E-09
aroclor 1254	6.68E-13	7.00E-05	9.54E-09
aroclor 1260	7.05E-13	7.00E-05	1.01E-08
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	4.34E-12	4.00E-02	1.09E-10
benzo(a)pyrene	9.18E-12	4.00E-02	2.30E-10
benzo(b)fluoranthene	9.35E-12	4.00E-02	2.34E-10
benzo(k)fluoranthene	8.40E-12	4.00E-02	2.10E-10
bis(2-ethylhexyl)phthalate	4.22E-12	2.00E-02	2.11E-10
chrysene	5.00E-12	4.00E-02	1.25E-10
dibenzo(a,h)anthracene	3.50E-12	4.00E-02	8.75E-11
fluoranthene	4.84E-12	4.00E-01	1.21E-11
indeno(1,2,3-cd)pyrene	8.69E-12	4.00E-02	2.17E-10
naphthalene	8.81E-12	4.00E-02	2.20E-10
n-butylbenzene	9.64E-07	2.90E-01	3.32E-06
n-propylbenzene	1.55E-06	2.90E-01	5.35E-06
p-cymene	4.29E-07	1.00E-01	4.29E-06
phenanthrene	5.82E-12	3.00E-01	1.94E-11
pyrene	5.25E-12	3.00E-01	1.75E-11
tetrachloroethene	2.93E-06	1.00E-01	2.93E-05
trichloroethene	6.16E-06	7.35E-03	8.39E-04
xylenes	1.49E-06	2.00E-01	7.43E-06
	HQ Summation =		7.1E-03

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	5.48E-07	NA	NA
1,2,4-trimethylbenzene	2.89E-08	NA	NA
1,3,5-trimethylbenzene	2.78E-08	NA	NA
aroclor 1248	9.54E-15	7.70E+00	7.35E-14
aroclor 1254	9.54E-15	7.70E+00	7.35E-14
aroclor 1260	1.01E-14	7.70E+00	7.76E-14
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	6.21E-14	3.90E-01	2.42E-14
benzo(a)pyrene	1.31E-13	3.90E+00	5.12E-13
benzo(b)fluoranthene	1.34E-13	3.90E-01	5.21E-14
benzo(k)fluoranthene	1.20E-13	3.90E-01	4.68E-14
bis(2-ethylhexyl)phthalate	6.03E-14	8.40E-03	5.07E-16
chrysene	7.14E-14	3.90E-02	2.79E-15
dibenzo(a,h)anthracene	5.00E-14	4.10E+00	2.05E-13
fluoranthene	6.91E-14	NA	NA
indeno(1,2,3-cd)pyrene	1.24E-13	3.90E-01	4.84E-14
naphthalene	1.26E-13	NA	NA
n-butylbenzene	1.38E-08	NA	NA
n-propylbenzene	2.22E-08	NA	NA
p-cymene	6.13E-09	NA	NA
phenanthrene	8.32E-14	NA	NA
pyrene	7.50E-14	NA	NA
tetrachloroethene	4.19E-08	2.10E-02	8.79E-10
trichloroethene	8.80E-08	1.00E-02	8.80E-10
xylenes	2.12E-08	NA	NA
	ILCR Summation =		1.8E-09

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Table B-9
Summary of Potential Health Effects
On-Site Commercial/Industrial Worker AOPC 1

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Indoor Air	6.4E-05
Total Population Hazard Quotient =	6.4E-05

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Indoor Air	1.2E-10
Total Population Incremental Lifetime Cancer Risk =	1.2E-10

Table B-10
Summary of Risk Quantitation
On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Indoor Air

Intake Equation = $\frac{CS \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim indoors	8	h/d
Ci	Concentration of chemicals indoors (indoor + outdoor)	(see Tables 5-6 and 5-7)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	1.64E-05
1,2,4-trimethylbenzene	2.80E-08
1,3,5-trimethylbenzene	5.58E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	1.97E-08
n-propylbenzene	6.01E-08
p-cymene	3.54E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	2.53E-07
trichloroethene	5.45E-07
xylenes	3.82E-08

Table B-10 (cont.)
Summary of Risk Quantitation
On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Indoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	5.32E-07	9.00E-03	5.91E-05
1,2,4-trimethylbenzene	9.09E-10	2.00E-03	4.54E-07
1,3,5-trimethylbenzene	1.81E-09	2.00E-03	9.06E-07
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	6.40E-10	2.90E-01	2.21E-09
n-propylbenzene	1.95E-09	2.90E-01	6.73E-09
p-cymene	1.15E-10	1.00E-01	1.15E-09
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	8.21E-09	1.00E-02	8.21E-07
trichloroethene	1.77E-08	7.35E-03	2.41E-06
xylenes	1.24E-09	2.00E-01	6.20E-09
	HQ Summation =		6.4E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	1.90E-07	NA	NA
1,2,4-trimethylbenzene	3.25E-10	NA	NA
1,3,5-trimethylbenzene	6.47E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	2.28E-10	NA	NA
n-propylbenzene	6.97E-10	NA	NA
p-cymene	4.11E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	2.93E-09	2.10E-02	6.16E-11
trichloroethene	6.32E-09	1.00E-02	6.32E-11
xylenes	4.43E-10	NA	NA
	ILCR Summation =		1.2E-10

Table B-11
Summary of Potential Health Effects
On-Site Commercial/Industrial Worker AOPC 2

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Indoor Air	8.7E-05
Total Population Hazard Quotient =	8.7E-05

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Indoor Air	1.7E-10
Total Population Incremental Lifetime Cancer Risk =	1.7E-10

Table B-12
Summary of Risk Quantitation
On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Indoor Air

Intake Equation $= \dfrac{CS \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim indoor	8	h/d
Ci	Concentration of chemicals indoors (indoor + outdoor)	(see Tables 5-6 and 5-7)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	2.23E-05
1,2,4-trimethylbenzene	4.45E-08
1,3,5-trimethylbenzene	7.97E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	2.53E-08
n-propylbenzene	8.01E-08
p-cymene	4.65E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	2.90E-07
trichloroethene	8.25E-07
xylenes	3.01E-08

Table B-12 (cont.)
Summary of Risk Quantitation
On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Indoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	7.24E-07	9.00E-03	8.05E-05
1,2,4-trimethylbenzene	1.45E-09	2.00E-03	7.23E-07
1,3,5-trimethylbenzene	2.59E-09	2.00E-03	1.29E-06
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	8.22E-10	2.90E-01	2.83E-09
n-propylbenzene	2.60E-09	2.90E-01	8.97E-09
p-cymene	1.51E-10	1.00E-01	1.51E-09
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	9.42E-09	1.00E-02	9.42E-07
trichloroethene	2.68E-08	7.35E-03	3.65E-06
xylenes	9.77E-10	2.00E-01	4.88E-09
	HQ Summation =		8.7E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	2.59E-07	NA	NA
1,2,4-trimethylbenzene	5.16E-10	NA	NA
1,3,5-trimethylbenzene	9.25E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	2.94E-10	NA	NA
n-propylbenzene	9.29E-10	NA	NA
p-cymene	5.39E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	3.36E-09	2.10E-02	7.07E-11
trichloroethene	9.57E-09	1.00E-02	9.57E-11
xylenes	3.49E-10	NA	NA
	ILCR Summation =		1.7E-10

Table B-13
Summary of Potential Health Effects
DTSC Commercial/Industrial Worker AOPC 1

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Indoor Air	3.2E-05
Inhalation of Outdoor Air	2.4E-05
Incidental Ingestion of Soil	1.6E-03
Dermal Contact with Soil	2.9E-03
Total Population Hazard Quotient =	4.6E-03

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Indoor Air	6.2E-11
Inhalation of Outdoor Air	7.3E-11
Incidental Ingestion of Soil	7.9E-07
Dermal Contact with Soil	3.6E-06
Total Population Incremental Lifetime Cancer Risk =	4.4E-06

Table B-14
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Incidental Ingestion of Soils

Intake Equation = $\frac{CS \times EF \times ED \times CF \times IR}{BW \times AT}$

IRs	Ingestion rate of soil (RAGS, 1989)	50	mg/day
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	125	d/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	9125	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	Concentration (mg/kg)
1,1-dichloroethene	2.57E-03
1,2,4-trimethylbenzene	3.82E-03
1,3,5-trimethylbenzene	2.96E-03
aroclor 1248	3.69E-02
aroclor 1254	3.28E-02
aroclor 1260	2.08E-02
arsenic	1.56E+00
benzo(a)anthracene	2.43E-01
benzo(a)pyrene	3.39E-01
benzo(b)fluoranthene	3.91E-01
benzo(k)fluoranthene	3.06E-01
bis(2-ethylhexyl)phthalate	2.58E-01
chrysene	2.86E-01
dibenzo(a,h)anthracene	1.36E-01
fluoranthene	2.66E-01
indeno(1,2,3-cd)pyrene	3.33E-01

Compound	Concentration (mg/kg)
naphthalene	2.05E-01
n-butylbenzene	2.81E-03
n-propylbenzene	2.57E-03
p-cymene	2.47E-03
phenanthrene	2.03E-01
pyrene	3.12E-01
tetrachloroethene	2.69E-03
trichloroethene	2.63E-03
xylenes	2.34E-03

Table B-14 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Incidental Ingestion of Soils

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	UH (unitless)
1,1-dichloroethene	6.29E-10	9.00E-03	6.99E-08
1,2,4-trimethylbenzene	9.34E-10	5.00E-01	1.87E-09
1,3,5-trimethylbenzene	7.24E-10	5.00E-01	1.45E-09
aroclor 1248	9.03E-09	7.00E-05	1.29E-04
aroclor 1254	8.02E-09	7.00E-05	1.15E-04
aroclor 1260	5.09E-09	7.00E-05	7.27E-05
arsenic	3.82E-07	3.00E-04	1.27E-03
benzo(a)anthracene	5.94E-08	4.00E-02	1.49E-06
benzo(a)pyrene	8.29E-08	4.00E-02	2.07E-06
benzo(b)fluoranthene	9.56E-08	4.00E-02	2.39E-06
benzo(k)fluoranthene	7.49E-08	4.00E-02	1.87E-06
bis(2-ethylhexyl)phthalate	6.31E-08	2.00E-02	3.16E-06
chrysene	7.00E-08	4.00E-02	1.75E-06
dibenzo(a,h)anthracene	3.33E-08	4.00E-02	8.32E-07
fluoranthene	6.51E-08	4.00E-02	1.63E-06
indeno(1,2,3-cd)pyrene	8.15E-08	4.00E-02	2.04E-06
naphthalene	5.01E-08	4.00E-02	1.25E-06
n-butylbenzene	6.87E-10	1.00E-01	6.87E-09
n-propylbenzene	6.29E-10	1.00E-01	6.29E-09
p-cymene	6.04E-10	1.00E-01	6.04E-09
phenanthrene	4.97E-08	3.00E-01	1.66E-07
pyrene	7.63E-08	3.00E-02	2.54E-06
tetrachloroethene	6.58E-10	1.00E-02	6.58E-08
trichloroethene	6.43E-10	7.35E-03	8.75E-08
xylenes	5.72E-10	2.00E+00	2.86E-10
	HQ Summation =		1.6E-03

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF (mg/kg-d)-1	UR (unitless)
1,1-dichloroethene	2.25E-10	NA	NA
1,2,4-trimethylbenzene	3.34E-10	NA	NA
1,3,5-trimethylbenzene	2.59E-10	NA	NA
aroclor 1248	3.22E-09	7.70E+00	2.48E-08
aroclor 1254	2.87E-09	7.70E+00	2.21E-08
aroclor 1260	1.82E-09	7.70E+00	1.40E-08
arsenic	1.36E-07	1.50E+00	2.04E-07
benzo(a)anthracene	2.12E-08	1.15E+00	2.44E-08
benzo(a)pyrene	2.96E-08	1.15E+01	3.41E-07
benzo(b)fluoranthene	3.42E-08	1.15E+00	3.93E-08
benzo(k)fluoranthene	2.67E-08	1.15E+00	3.07E-08
bis(2-ethylhexyl)phthalate	2.25E-08	8.40E-03	1.89E-10
chrysene	2.50E-08	1.15E-01	2.87E-09
dibenzo(a,h)anthracene	1.19E-08	4.10E+00	4.87E-08
fluoranthene	2.32E-08	NA	NA
indeno(1,2,3-cd)pyrene	2.91E-08	1.15E+00	3.35E-08
naphthalene	1.79E-08	NA	NA
n-butylbenzene	2.45E-10	NA	NA
n-propylbenzene	2.25E-10	NA	NA
p-cymene	2.16E-10	NA	NA
phenanthrene	1.77E-08	NA	NA
pyrene	2.73E-08	NA	NA
tetrachloroethene	2.35E-10	5.10E-02	1.20E-11
trichloroethene	2.30E-10	1.50E-02	3.45E-12
xylenes	2.04E-10	NA	NA
	ILCR Summation =		7.9E-07

Table B-15
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Dermal Contact with Soils

Intake Equation = $\frac{CS \times CF \times EF \times ED \times AF \times ABS \times SA}{BW \times AT}$

SA	Surface area of exposed skin (50th percentile, hands only)	2020	cm^2/day
AF	Adherence Factor	1	mg/cm^2
ABS	Absorption factor (see table below)	csv	
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	125	d/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	9125	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	ABS (unitless)	Concentration (mg/kg)
1,1-dichloroethene	1.00E-01	2.57E-03
1,2,4-trimethylbenzene	1.00E-01	3.82E-03
1,3,5-trimethylbenzene	1.00E-01	2.96E-03
aroclor 1248	1.00E-01	3.69E-02
aroclor 1254	1.00E-01	3.28E-02
aroclor 1260	1.00E-01	2.08E-02
arsenic	3.00E-02	1.56E+00
benzo(a)anthracene	1.50E-01	2.43E-01
benzo(a)pyrene	1.50E-01	3.39E-01
benzo(b)fluoranthene	1.50E-01	3.91E-01
benzo(k)fluoranthene	1.50E-01	3.06E-01
bis(2-ethylhexyl)phthalate	1.00E-01	2.58E-01
chrysene	1.50E-01	2.86E-01
dibenzo(a,h)anthracene	1.50E-01	1.36E-01
fluoranthene	1.00E-01	2.66E-01
indeno(1,2,3-cd)pyrene	1.00E-01	3.33E-01

Compound	ABS (unitless)	Concentration (mg/kg)
naphthalene	1.50E-01	2.05E-01
n-butylbenzene	1.00E-01	2.81E-03
n-propylbenzene	1.00E-01	2.57E-03
p-cymene	1.00E-01	2.47E-03
phenanthrene	1.50E-01	2.03E-01
pyrene	1.50E-01	3.12E-01
tetrachloroethene	1.00E-01	2.69E-03
trichloroethene	1.00E-01	2.63E-03
xylenes	1.00E-01	2.34E-03

Table B-15 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Dermal Contact with Soils

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	UH (unitless)
1,1-dichloroethene	2.54E-09	9.00E-03	2.82E-07
1,2,4-trimethylbenzene	3.78E-09	5.00E-01	7.55E-09
1,3,5-trimethylbenzene	2.93E-09	5.00E-01	5.85E-09
aroclor 1248	3.65E-08	7.00E-05	5.21E-04
aroclor 1254	3.24E-08	7.00E-05	4.63E-04
aroclor 1260	2.06E-08	7.00E-05	2.94E-04
arsenic	4.63E-07	3.00E-04	1.54E-03
benzo(a)anthracene	3.60E-07	4.00E-02	9.01E-06
benzo(a)pyrene	5.03E-07	4.00E-02	1.26E-05
benzo(b)fluoranthene	5.80E-07	4.00E-02	1.45E-05
benzo(k)fluoranthene	4.54E-07	4.00E-02	1.13E-05
bis(2-ethylhexyl)phthalate	2.55E-07	2.00E-02	1.27E-05
chrysene	4.24E-07	4.00E-02	1.06E-05
dibenzo(a,h)anthracene	2.02E-07	4.00E-02	5.04E-06
fluoranthene	2.63E-07	4.00E-02	6.57E-06
indeno(1,2,3-cd)pyrene	3.29E-07	4.00E-02	8.23E-06
naphthalene	3.04E-07	4.00E-02	7.60E-06
n-butylbenzene	2.78E-09	1.00E-01	2.78E-08
n-propylbenzene	2.54E-09	1.00E-01	2.54E-08
p-cymene	2.44E-09	1.00E-01	2.44E-08
phenanthrene	3.01E-07	3.00E-01	1.00E-06
pyrene	4.63E-07	3.00E-02	1.54E-05
tetrachloroethene	2.66E-09	1.00E-02	2.66E-07
trichloroethene	2.60E-09	7.35E-03	3.54E-07
xylenes	2.31E-09	2.00E+00	1.16E-09
	HQ Summation =		2.9E-03

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	UR (unitless)
1,1-dichloroethene	9.07E-10	NA	NA
1,2,4-trimethylbenzene	1.35E-09	NA	NA
1,3,5-trimethylbenzene	1.04E-09	NA	NA
aroclor 1248	1.30E-08	7.70E+00	1.00E-07
aroclor 1254	1.16E-08	7.70E+00	8.91E-08
aroclor 1260	7.34E-09	7.70E+00	5.65E-08
arsenic	1.65E-07	1.50E+00	2.48E-07
benzo(a)anthracene	1.29E-07	1.15E+00	1.48E-07
benzo(a)pyrene	1.79E-07	1.15E+01	2.06E-06
benzo(b)fluoranthene	2.07E-07	1.15E+00	2.38E-07
benzo(k)fluoranthene	1.62E-07	1.15E+00	1.86E-07
bis(2-ethylhexyl)phthalate	9.11E-08	8.40E-03	7.65E-10
chrysene	1.51E-07	1.15E-01	1.74E-08
dibenzo(a,h)anthracene	7.20E-08	4.10E+00	2.95E-07
fluoranthene	9.39E-08	NA	NA
indeno(1,2,3-cd)pyrene	1.18E-07	1.15E+00	1.35E-07
naphthalene	1.09E-07	NA	NA
n-butylbenzene	9.92E-10	NA	NA
n-propylbenzene	9.07E-10	NA	NA
p-cymene	8.72E-10	NA	NA
phenanthrene	1.07E-07	NA	NA
pyrene	1.65E-07	NA	NA
tetrachloroethene	9.49E-10	5.10E-02	4.84E-11
trichloroethene	9.28E-10	1.50E-02	1.39E-11
xylenes	8.26E-10	NA	NA
	ILCR Summation =		3.6E-06

Table B-16
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Indoor Air

Intake Equation = $\frac{Ci \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim indoor	4	h/d
Ci	Concentration of chemicals indoors (indoor + outdoor)	(see Tables 5-6 and 5-7)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	1.64E-05
1,2,4-trimethylbenzene	2.80E-08
1,3,5-trimethylbenzene	5.58E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	1.97E-08
n-propylbenzene	6.01E-08
p-cymene	3.54E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	2.53E-07
trichloroethene	5.45E-07
xylenes	3.82E-08

Table B-16 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Indoor Air

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.66E-07	9.00E-03	2.95E-05
1,2,4-trimethylbenzene	4.54E-10	2.00E-03	2.27E-07
1,3,5-trimethylbenzene	9.06E-10	2.00E-03	4.53E-07
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	3.20E-10	2.90E-01	1.10E-09
n-propylbenzene	9.76E-10	2.90E-01	3.37E-09
p-cymene	5.75E-11	1.00E-01	5.75E-10
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	4.11E-09	1.00E-02	4.11E-07
trichloroethene	8.85E-09	7.35E-03	1.20E-06
xylenes	6.20E-10	2.00E-01	3.10E-09
	HQ Summation =		3.2E-05

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	9.50E-08	NA	NA
1,2,4-trimethylbenzene	1.62E-10	NA	NA
1,3,5-trimethylbenzene	3.24E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	1.14E-10	NA	NA
n-propylbenzene	3.49E-10	NA	NA
p-cymene	2.05E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	1.47E-09	2.10E-02	3.08E-11
trichloroethene	3.16E-09	1.00E-02	3.16E-11
xylenes	2.22E-10	NA	NA
	ILCR Summation =		6.2E-11

Table B-17
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Outdoor Air

Intake Equation = $\frac{\{Ci + (Cs \; X \; 1/PEF)\} \; X \; EF \; X \; ED \; X \; ET \; X \; IR}{BW \; X \; AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim outdoor	4	h/d
Ci	Concentration of volatiles in ambient air	(see Table 5-6)	
PEF	Particulate Emission Factor (see Table below)	(see Section 5.3.1.2)	

Chemical Concentrations

Compound	Soil Conc (mg/kg)	PEF (m3/kg)	Volatile Concentration (mg/m3)
1,1-dichloroethene	2.57E-03	NA	1.24E-05
1,2,4-trimethylbenzene	3.82E-03	NA	2.38E-08
1,3,5-trimethylbenzene	2.96E-03	NA	4.37E-08
aroclor 1248	3.69E-02	4.77E+09	NA
aroclor 1254	3.28E-02	4.77E+09	NA
aroclor 1260	2.08E-02	4.77E+09	NA
arsenic	1.56E+00	4.77E+09	NA
benzo(a)anthracene	2.43E-01	4.77E+09	NA
benzo(a)pyrene	3.39E-01	4.77E+09	NA
benzo(b)fluoranthene	3.91E-01	4.77E+09	NA
benzo(k)fluoranthene	3.06E-01	4.77E+09	NA
bis(2-ethylhexyl)phtha	2.58E-01	4.77E+09	NA
chrysene	2.86E-01	4.77E+09	NA
dibenzo(a,h)anthracene	1.36E-01	4.77E+09	NA
fluoranthene	2.66E-01	4.77E+09	NA
indeno(1,2,3-cd)pyrene	3.33E-01	4.77E+09	NA

Compound	Soil Conc (mg/k	PEF	Volatile Concentration (mg/m3)
naphthalene	2.05E-01	4.77E+09	NA
n-butylbenzene	2.81E-03	NA	1.43E-08
n-propylbenzene	2.57E-03	NA	4.48E-08
p-cymene	2.47E-03	NA	2.61E-09
phenanthrene	2.03E-01	4.77E+09	NA
pyrene	3.12E-01	4.77E+09	NA
tetrachloroethene	2.69E-03	NA	1.70E-07
trichloroethene	2.63E-03	NA	4.46E-07
xylenes	2.34E-03	NA	2.79E-08

Table B-17 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 1
Via Inhalation of Outdoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.01E-07	9.00E-03	2.24E-05
1,2,4-trimethylbenzene	3.87E-10	2.00E-03	1.93E-07
1,3,5-trimethylbenzene	7.10E-10	2.00E-03	3.55E-07
aroclor 1248	1.26E-13	7.00E-05	1.79E-09
aroclor 1254	1.12E-13	7.00E-05	1.59E-09
aroclor 1260	7.08E-14	7.00E-05	1.01E-09
arsenic	5.31E-12	3.00E-04	1.77E-08
benzo(a)anthracene	8.27E-13	4.00E-02	2.07E-11
benzo(a)pyrene	1.15E-12	4.00E-02	2.88E-11
benzo(b)fluoranthene	1.33E-12	4.00E-02	3.33E-11
benzo(k)fluoranthene	1.04E-12	4.00E-02	2.60E-11
bis(2-ethylhexyl)phthalate	8.78E-13	2.00E-02	4.39E-11
chrysene	9.73E-13	4.00E-02	2.43E-11
dibenzo(a,h)anthracene	4.63E-13	4.00E-02	1.16E-11
fluoranthene	9.05E-13	4.00E-02	2.26E-11
indeno(1,2,3-cd)pyrene	1.13E-12	4.00E-02	2.83E-11
naphthalene	6.97E-13	4.00E-02	1.74E-11
n-butylbenzene	2.32E-10	2.90E-01	8.01E-10
n-propylbenzene	7.28E-10	2.90E-01	2.51E-09
p-cymene	4.24E-11	1.00E-01	4.24E-10
phenanthrene	6.91E-13	3.00E-01	2.30E-12
pyrene	1.06E-12	3.00E-02	3.54E-11
tetrachloroethene	2.76E-09	1.00E-02	2.76E-07
trichloroethene	7.24E-09	7.35E-03	9.86E-07
xylenes	4.53E-10	2.00E-01	2.27E-09
	HQ Summation =		2.4E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	7.19E-08	NA	NA
1,2,4-trimethylbenzene	1.38E-10	NA	NA
1,3,5-trimethylbenzene	2.54E-10	NA	NA
aroclor 1248	4.48E-14	7.70E+00	3.45E-13
aroclor 1254	3.99E-14	7.70E+00	3.07E-13
aroclor 1260	2.53E-14	7.70E+00	1.95E-13
arsenic	1.90E-12	1.20E+01	2.27E-11
benzo(a)anthracene	2.95E-13	3.90E-01	1.15E-13
benzo(a)pyrene	4.12E-13	3.90E+00	1.61E-12
benzo(b)fluoranthene	4.75E-13	3.90E-01	1.85E-13
benzo(k)fluoranthene	3.72E-13	3.90E-01	1.45E-13
bis(2-ethylhexyl)phthalate	3.13E-13	8.40E-03	2.63E-15
chrysene	3.48E-13	3.90E-02	1.36E-14
dibenzo(a,h)anthracene	1.65E-13	4.10E+00	6.78E-13
fluoranthene	3.23E-13	NA	NA
indeno(1,2,3-cd)pyrene	4.05E-13	3.90E-01	1.58E-13
naphthalene	2.49E-13	NA	NA
n-butylbenzene	8.30E-11	NA	NA
n-propylbenzene	2.60E-10	NA	NA
p-cymene	1.51E-11	NA	NA
phenanthrene	2.47E-13	NA	NA
pyrene	3.79E-13	NA	NA
tetrachloroethene	9.86E-10	2.10E-02	2.07E-11
trichloroethene	2.59E-09	1.00E-02	2.59E-11
xylenes	1.62E-10	NA	NA
	ILCR Summation =		7.3E-11

Table B-18
Summary of Potential Health Effects
DTSC Commercial/Industrial Worker AOPC 2

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Indoor Air	4.4E-05
Inhalation of Outdoor Air	2.4E-05
Incidental Ingestion of Soil	1.9E-04
Dermal Contact with Soil	7.7E-04
Total Population Hazard Quotient =	1.0E-03

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Indoor Air	8.3E-11
Inhalation of Outdoor Air	4.9E-11
Incidental Ingestion of Soil	3.7E-07
Dermal Contact with Soil	2.1E-06
Total Population Incremental Lifetime Cancer Risk =	2.5E-06

Table B-19
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Incidental Ingestion of Soils

Intake Equation =

$$\frac{CS \times EF \times ED \times CF \times IR}{BW \times AT}$$

IRs	Ingestion rate of soil (RAGS, 1989)	50	mg/day
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	125	d/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	9125	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	Concentration (mg/kg)
1,1-dichloroethene	4.05E-03
1,2,4-trimethylbenzene	1.85E-02
1,3,5-trimethylbenzene	8.93E-03
aroclor 1248	1.63E-02
aroclor 1254	1.63E-02
aroclor 1260	1.72E-02
arsenic	
benzo(a)anthracene	1.06E-01
benzo(a)pyrene	2.24E-01
benzo(b)fluoranthene	2.28E-01
benzo(k)fluoranthene	2.05E-01
bis(2-ethylhexyl)phthalate	1.03E-01
chrysene	1.22E-01
dibenzo(a,h)anthracene	8.54E-02
fluoranthene	1.18E-01
indeno(1,2,3-cd)pyrene	2.12E-01

Compound	Concentration (mg/kg)
naphthalene	2.15E-01
n-butylbenzene	6.18E-03
n-propylbenzene	5.78E-03
p-cymene	6.45E-03
phenanthrene	1.42E-01
pyrene	1.28E-01
tetrachloroethene	4.53E-03
trichloroethene	8.56E-03
xylenes	6.45E-03

Table B-19 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Incidental Ingestion of Soils

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	UH (unitless)
1,1-dichloroethene	9.91E-10	9.00E-03	1.10E-07
1,2,4-trimethylbenzene	4.53E-09	5.00E-01	9.05E-09
1,3,5-trimethylbenzene	2.18E-09	5.00E-01	4.37E-09
aroclor 1248	3.99E-09	7.00E-05	5.70E-05
aroclor 1254	3.99E-09	7.00E-05	5.70E-05
aroclor 1260	4.21E-09	7.00E-05	6.01E-05
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	2.59E-08	4.00E-02	6.48E-07
benzo(a)pyrene	5.48E-08	4.00E-02	1.37E-06
benzo(b)fluoranthene	5.58E-08	4.00E-02	1.39E-06
benzo(k)fluoranthene	5.01E-08	4.00E-02	1.25E-06
bis(2-ethylhexyl)phthalate	2.52E-08	2.00E-02	1.26E-06
chrysene	2.98E-08	4.00E-02	7.46E-07
dibenzo(a,h)anthracene	2.09E-08	4.00E-02	5.22E-07
fluoranthene	2.89E-08	4.00E-02	7.22E-07
indeno(1,2,3-cd)pyrene	5.19E-08	4.00E-02	1.30E-06
naphthalene	5.26E-08	4.00E-02	1.31E-06
n-butylbenzene	1.51E-09	1.00E-01	1.51E-08
n-propylbenzene	1.41E-09	1.00E-01	1.41E-08
p-cymene	1.58E-09	1.00E-01	1.58E-08
phenanthrene	3.47E-08	3.00E-01	1.16E-07
pyrene	3.13E-08	3.00E-02	1.04E-06
tetrachloroethene	1.11E-09	1.00E-02	1.11E-07
trichloroethene	2.09E-09	7.35E-03	2.85E-07
xylenes	1.58E-09	2.00E+00	7.89E-10
	HQ Summation =		1.9E-04

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	UR (unitless)
1,1-dichloroethene	3.54E-10	NA	NA
1,2,4-trimethylbenzene	1.62E-09	NA	NA
1,3,5-trimethylbenzene	7.80E-10	NA	NA
aroclor 1248	1.42E-09	7.70E+00	1.10E-08
aroclor 1254	1.42E-09	7.70E+00	1.10E-08
aroclor 1260	1.50E-09	7.70E+00	1.16E-08
arsenic	NA	1.50E+00	NA
benzo(a)anthracene	9.26E-09	1.15E+00	1.06E-08
benzo(a)pyrene	1.96E-08	1.15E+01	2.25E-07
benzo(b)fluoranthene	1.99E-08	1.15E+00	2.29E-08
benzo(k)fluoranthene	1.79E-08	1.15E+00	2.06E-08
bis(2-ethylhexyl)phthalate	9.00E-09	8.40E-03	7.56E-11
chrysene	1.07E-08	1.15E-01	1.23E-09
dibenzo(a,h)anthracene	7.46E-09	4.10E+00	3.06E-08
fluoranthene	1.03E-08	NA	NA
indeno(1,2,3-cd)pyrene	1.85E-08	1.15E+00	2.13E-08
naphthalene	1.88E-08	NA	NA
n-butylbenzene	5.40E-10	NA	NA
n-propylbenzene	5.05E-10	NA	NA
p-cymene	5.63E-10	NA	NA
phenanthrene	1.24E-08	NA	NA
pyrene	1.12E-08	NA	NA
tetrachloroethene	3.96E-10	5.10E-02	2.02E-11
trichloroethene	7.48E-10	1.50E-02	1.12E-11
xylenes	5.63E-10	NA	NA
	ILCR Summation =		3.7E-07

Table B-20
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Dermal Contact with Soils

Intake Equation = $\frac{CS \times CF \times EF \times ED \times AF \times ABS \times SA}{BW \times AT}$

SA	Surface area of exposed skin (50th percentile, hands only)	2020	cm^2/day
AF	Adherence Factor	1	mg/cm^2
ABS	Absorption factor (see table below)	csv	
CF	Conversion factor	1.0E-06	kg/mg
EF	Exposure frequency	125	d/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	day
ATn	Average time for non-carcinogens (EDn x 365)	9125	day
CS	Concentration of chemicals in soil	(see Table 5-1)	

Chemical Concentrations

Compound	ABS (unitless)	Concentration (mg/kg)
1,1-dichloroethene	1.00E-01	4.05E-03
1,2,4-trimethylbenzene	1.00E-01	1.85E-02
1,3,5-trimethylbenzene	1.00E-01	8.93E-03
aroclor 1248	1.00E-01	1.63E-02
aroclor 1254	1.00E-01	1.63E-02
aroclor 1260	1.00E-01	1.72E-02
arsenic	3.00E-02	NA
benzo(a)anthracene	1.50E-01	1.06E-01
benzo(a)pyrene	1.50E-01	2.24E-01
benzo(b)fluoranthene	1.50E-01	2.28E-01
benzo(k)fluoranthene	1.50E-01	2.05E-01
bis(2-ethylhexyl)phthalate	1.00E-01	1.03E-01
chrysene	1.50E-01	1.22E-01
dibenzo(a,h)anthracene	1.50E-01	8.54E-02
fluoranthene	1.00E-01	1.18E-01
indeno(1,2,3-cd)pyrene	1.00E-01	2.12E-01

Compound	ABS (unitless)	Concentration (mg/kg)
naphthalene	1.50E-01	2.15E-01
n-butylbenzene	1.00E-01	6.18E-03
n-propylbenzene	1.00E-01	5.78E-03
p-cymene	1.00E-01	6.45E-03
phenanthrene	1.50E-01	1.42E-01
pyrene	1.50E-01	1.28E-01
tetrachloroethene	1.00E-01	4.53E-03
trichloroethene	1.00E-01	8.56E-03
xylenes	1.00E-01	6.45E-03

Table B-20 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Dermal Contact with Soils

Compound	Non-Carcinogenic Calculation CDI (mg/kg-d)	RfD (mg/kg-d)	UH (unitless)
1,1-dichloroethene	4.00E-09	9.00E-03	4.45E-07
1,2,4-trimethylbenzene	1.83E-08	5.00E-01	3.66E-08
1,3,5-trimethylbenzene	8.83E-09	5.00E-01	1.77E-08
aroclor 1248	1.61E-08	7.00E-05	2.30E-04
aroclor 1254	1.61E-08	7.00E-05	2.30E-04
aroclor 1260	1.70E-08	7.00E-05	2.43E-04
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	1.57E-07	4.00E-02	3.93E-06
benzo(a)pyrene	3.32E-07	4.00E-02	8.30E-06
benzo(b)fluoranthene	3.38E-07	4.00E-02	8.45E-06
benzo(k)fluoranthene	3.04E-07	4.00E-02	7.60E-06
bis(2-ethylhexyl)phthalate	1.02E-07	2.00E-02	5.09E-06
chrysene	1.81E-07	4.00E-02	4.52E-06
dibenzo(a,h)anthracene	1.27E-07	4.00E-02	3.16E-06
fluoranthene	1.17E-07	4.00E-02	2.92E-06
indeno(1,2,3-cd)pyrene	2.10E-07	4.00E-02	5.24E-06
naphthalene	3.19E-07	4.00E-02	7.97E-06
n-butylbenzene	6.11E-09	1.00E-01	6.11E-08
n-propylbenzene	5.71E-09	1.00E-01	5.71E-08
p-cymene	6.37E-09	1.00E-01	6.37E-08
phenanthrene	2.10E-07	3.00E-01	7.02E-07
pyrene	1.90E-07	3.00E-02	6.32E-06
tetrachloroethene	4.48E-09	1.00E-02	4.48E-07
trichloroethene	8.46E-09	7.35E-03	1.15E-06
xylenes	6.37E-09	2.00E+00	3.19E-09
	HQ Summation =		7.7E-04

Compound	Carcinogenic Calculation CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	UR (unitless)
1,1-dichloroethene	1.43E-09	NA	NA
1,2,4-trimethylbenzene	6.53E-09	NA	NA
1,3,5-trimethylbenzene	3.15E-09	NA	NA
aroclor 1248	5.75E-09	7.70E+00	4.43E-08
aroclor 1254	5.75E-09	7.70E+00	4.43E-08
aroclor 1260	6.07E-09	7.70E+00	4.67E-08
arsenic	NA	1.50E+00	NA
benzo(a)anthracene	5.61E-08	1.15E+00	6.45E-08
benzo(a)pyrene	1.19E-07	1.15E+01	1.36E-06
benzo(b)fluoranthene	1.21E-07	1.15E+00	1.39E-07
benzo(k)fluoranthene	1.09E-07	1.15E+00	1.25E-07
bis(2-ethylhexyl)phthalate	3.64E-08	8.40E-03	3.05E-10
chrysene	6.46E-08	1.15E-01	7.43E-09
dibenzo(a,h)anthracene	4.52E-08	4.10E+00	1.85E-07
fluoranthene	4.16E-08	NA	NA
indeno(1,2,3-cd)pyrene	7.48E-08	1.15E+00	8.60E-08
naphthalene	1.14E-07	NA	NA
n-butylbenzene	2.18E-09	NA	NA
n-propylbenzene	2.04E-09	NA	NA
p-cymene	2.28E-09	NA	NA
phenanthrene	7.52E-08	NA	NA
pyrene	6.78E-08	NA	NA
tetrachloroethene	1.60E-09	5.10E-02	8.15E-11
trichloroethene	3.02E-09	1.50E-02	4.53E-11
xylenes	2.28E-09	NA	NA
	ILCR Summation =		2.1E-06

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Table B-21
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Indoor Air

Intake Equation = $\frac{Ci \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim indoor	4	h/d
Ci	Concentration of chemicals indoors (indoor + outdoor)	(see Tables 5-6 and 5-7)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	2.23E-05
1,2,4-trimethylbenzene	4.45E-08
1,3,5-trimethylbenzene	7.97E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	2.53E-08
n-propylbenzene	8.01E-08
p-cymene	4.65E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	2.90E-07
trichloroethene	8.25E-07
xylenes	3.01E-08

Table B-21 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Indoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	3.62E-07	9.00E-03	4.02E-05
1,2,4-trimethylbenzene	7.23E-10	2.00E-03	3.61E-07
1,3,5-trimethylbenzene	1.29E-09	2.00E-03	6.47E-07
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	4.11E-10	2.90E-01	1.42E-09
n-propylbenzene	1.30E-09	2.90E-01	4.49E-09
p-cymene	7.55E-11	1.00E-01	7.55E-10
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	4.71E-09	1.00E-02	4.71E-07
trichloroethene	1.34E-08	7.35E-03	1.82E-06
xylenes	4.88E-10	2.00E-01	2.44E-09
	HQ Summation =		4.4E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	1.29E-07	NA	NA
1,2,4-trimethylbenzene	2.58E-10	NA	NA
1,3,5-trimethylbenzene	4.62E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	1.47E-10	NA	NA
n-propylbenzene	4.65E-10	NA	NA
p-cymene	2.70E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	1.68E-09	2.10E-02	3.53E-11
trichloroethene	4.79E-09	1.00E-02	4.79E-11
xylenes	1.74E-10	NA	NA
	ILCR Summation =		8.3E-11

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Table B-22
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Outdoor Air

Intake Equation = $\frac{\{Ci + (Cs \times 1/PEF)\} \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure tim outdoor	4	h/d
Ci	Concentration of chemicals outdoors	(see Table 5-6)	
PEF	Particulate Emission Factor	(see Section 5.3.1.2)	

Chemical Concentrations

Compound	Soil Conc (mg/kg)	PEF (m3/kg)	Volatile Concentration (mg/m3)
1,1-dichloroethene	4.05E-03	NA	1.24E-05
1,2,4-trimethylbenzen	1.85E-02	NA	2.38E-08
1,3,5-trimethylbenzen	8.93E-03	NA	4.37E-08
aroclor 1248	1.63E-02	4.77E+09	NA
aroclor 1254	1.63E-02	4.77E+09	NA
aroclor 1260	1.72E-02	4.77E+09	NA
arsenic	NA	4.77E+09	NA
benzo(a)anthracene	1.06E-01	4.77E+09	NA
benzo(a)pyrene	2.24E-01	4.77E+09	NA
benzo(b)fluoranthene	2.28E-01	4.77E+09	NA
benzo(k)fluoranthene	2.05E-01	4.77E+09	NA
bis(2-ethylhexyl)phtha	1.03E-01	4.77E+09	NA
chrysene	1.22E-01	4.77E+09	NA
dibenzo(a,h)anthracen	8.54E-02	4.77E+09	NA
fluoranthene	1.18E-01	4.77E+09	NA
indeno(1,2,3-cd)pyren	2.12E-01	4.77E+09	NA

Compound	Soil Conc (mg/k	PEF	Volatile Concentration (mg/m3)
naphthalene	2.15E-01	4.77E+09	NA
n-butylbenzene	6.18E-03	NA	1.43E-08
n-propylbenzene	5.78E-03	NA	4.48E-08
p-cymene	6.45E-03	NA	2.61E-09
phenanthrene	1.42E-01	4.77E+09	NA
pyrene	1.28E-01	4.77E+09	NA
tetrachloroethene	4.53E-03	NA	1.70E-07
trichloroethene	8.56E-03	NA	4.46E-07
xylenes	6.45E-03	NA	2.79E-08

Table B-22 (cont.)
Summary of Risk Quantitation
DTSC On-Site Commercial/Industrial Worker AOPC 2
Via Inhalation of Outdoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.01E-07	9.00E-03	2.24E-05
1,2,4-trimethylbenzene	3.87E-10	2.00E-03	1.93E-07
1,3,5-trimethylbenzene	7.10E-10	2.00E-03	3.55E-07
aroclor 1248	5.55E-14	7.00E-05	7.92E-10
aroclor 1254	5.55E-14	7.00E-05	7.92E-10
aroclor 1260	5.85E-14	7.00E-05	8.36E-10
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	3.61E-13	4.00E-02	9.02E-12
benzo(a)pyrene	7.62E-13	4.00E-02	1.91E-11
benzo(b)fluoranthene	7.76E-13	4.00E-02	1.94E-11
benzo(k)fluoranthene	6.97E-13	4.00E-02	1.74E-11
bis(2-ethylhexyl)phthalate	3.50E-13	2.00E-02	1.75E-11
chrysene	4.15E-13	4.00E-02	1.04E-11
dibenzo(a,h)anthracene	2.91E-13	4.00E-02	7.26E-12
fluoranthene	4.01E-13	4.00E-02	1.00E-11
indeno(1,2,3-cd)pyrene	7.21E-13	4.00E-02	1.80E-11
naphthalene	7.31E-13	4.00E-02	1.83E-11
n-butylbenzene	2.32E-10	2.90E-01	8.01E-10
n-propylbenzene	7.28E-10	2.90E-01	2.51E-09
p-cymene	4.24E-11	1.00E-01	4.24E-10
phenanthrene	4.83E-13	3.00E-01	1.61E-12
pyrene	4.35E-13	3.00E-02	1.45E-11
tetrachloroethene	2.76E-09	1.00E-02	2.76E-07
trichloroethene	7.24E-09	7.35E-03	9.86E-07
xylenes	4.53E-10	2.00E-01	2.27E-09
	HQ Summation =		2.4E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	7.19E-08	NA	NA
1,2,4-trimethylbenzene	1.38E-10	NA	NA
1,3,5-trimethylbenzene	2.54E-10	NA	NA
aroclor 1248	1.98E-14	7.70E+00	1.53E-13
aroclor 1254	1.98E-14	7.70E+00	1.53E-13
aroclor 1260	2.09E-14	7.70E+00	1.61E-13
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	1.29E-13	3.90E-01	5.02E-14
benzo(a)pyrene	2.72E-13	3.90E+00	1.06E-12
benzo(b)fluoranthene	2.77E-13	3.90E-01	1.08E-13
benzo(k)fluoranthene	2.49E-13	3.90E-01	9.71E-14
bis(2-ethylhexyl)phthalate	1.25E-13	8.40E-03	1.05E-15
chrysene	1.48E-13	3.90E-02	5.78E-15
dibenzo(a,h)anthracene	1.04E-13	4.10E+00	4.25E-13
fluoranthene	1.43E-13	NA	NA
indeno(1,2,3-cd)pyrene	2.58E-13	3.90E-01	1.00E-13
naphthalene	2.61E-13	NA	NA
n-butylbenzene	8.30E-11	NA	NA
n-propylbenzene	2.60E-10	NA	NA
p-cymene	1.51E-11	NA	NA
phenanthrene	1.73E-13	NA	NA
pyrene	1.56E-13	NA	NA
tetrachloroethene	9.86E-10	2.10E-02	2.07E-11
trichloroethene	2.59E-09	1.00E-02	2.59E-11
xylenes	1.62E-10	NA	NA
	ILCR Summation =		4.9E-11

Table B-23
Summary of Potential Health Effects
Off-Site Commercial/Industrial Worker

Exposure Pathway	**Receptor Hazard Quotient**
Inhalation of Outdoor Air	2.5E-05
Total Population Hazard Quotient =	2.5E-05

Exposure Pathway	**Receptor Incremental Lifetime Cancer Risk**
Inhalation of Outdoor Air	5.2E-11
Total Population Incremental Lifetime Cancer Risk =	5.2E-11

Table B-24
Summary of Risk Quantitation
Off-Site Commercial/Industrial Worker
Via Inhalation of Outdoor Air

Intake Equation $= \dfrac{CS \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m^3/h
EF	Exposure frequency	125	days/year
EDn	Exposure duration for non-carcinogens	25	year
EDc	Exposure duration for carcinogens	25	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	9125	days
ET	Exposure time outdoors	8	h/d
Ci	Concentration of chemicals indoors	(see Table 5-6)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	6.57E-06
1,2,4-trimethylbenzene	7.04E-09
1,3,5-trimethylbenzene	2.01E-08
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	8.90E-09
n-propylbenzene	2.54E-08
p-cymene	1.54E-09
phenanthrene	NA
pyrene	NA
tetrachloroethene	1.36E-07
trichloroethene	1.66E-07
xylenes	1.70E-08

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Table B-24 (cont.)
Summary of Risk Quantitation
Off-Site Commercial/Industrial Worker
Via Inhalation of Outdoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	2.13E-07	9.00E-03	2.37E-05
1,2,4-trimethylbenzene	2.29E-10	2.00E-03	1.14E-07
1,3,5-trimethylbenzene	6.53E-10	2.00E-03	3.26E-07
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	2.89E-10	2.90E-01	9.97E-10
n-propylbenzene	8.25E-10	2.90E-01	2.85E-09
p-cymene	5.00E-11	1.00E-01	5.00E-10
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	4.42E-09	1.00E-02	4.42E-07
trichloroethene	5.39E-09	7.35E-03	7.34E-07
xylenes	5.52E-10	2.00E-01	2.76E-09
	HQ Summation =		2.5E-05

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF $(mg/kg\text{-}d)^{-1}$	ILCR (unitless)
1,1-dichloroethene	7.62E-08	NA	NA
1,2,4-trimethylbenzene	8.17E-11	NA	NA
1,3,5-trimethylbenzene	2.33E-10	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	1.03E-10	NA	NA
n-propylbenzene	2.95E-10	NA	NA
p-cymene	1.79E-11	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	1.58E-09	2.10E-02	3.31E-11
trichloroethene	1.93E-09	1.00E-02	1.93E-11
xylenes	1.97E-10	NA	NA
	ILCR Summation =		5.2E-11

Table B-25
Summary of Potential Health Effects
Off-Site RME Resident Adult

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Outdoor Air	1.2E-06
Total Population Hazard Quotient =	1.2E-06

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Outdoor Air	2.9E-12
Total Population Incremental Lifetime Cancer Risk =	2.9E-12

Table B-26
Summary of Risk Quantitation
Off-Site RME Resident Adult
Via Inhalation of Outdoor Air

Intake Equation = $\frac{CS \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	350	days/year
EDn	Exposure duration for non-carcinogens	30	year
EDc	Exposure duration for carcinogens	30	year
BW	Body weight	70	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	10950	days
ET	Exposure time	24	h/d
Ci	Concentration of chemicals Outdoors	(see Table 5-6)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	3.65E-08
1,2,4-trimethylbenzene	3.83E-11
1,3,5-trimethylbenzene	1.11E-10
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	4.96E-11
n-propylbenzene	1.41E-10
p-cymene	8.57E-12
phenanthrene	NA
pyrene	NA
tetrachloroethene	7.61E-10
trichloroethene	9.09E-10
xylenes	9.47E-11

Table B-26 (cont.)
Summary of Risk Quantitation
Off-Site RME Resident Adult
Via Inhalation of Outdoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	9.96E-09	9.00E-03	1.11E-06
1,2,4-trimethylbenzene	1.05E-11	2.00E-03	5.23E-09
1,3,5-trimethylbenzene	3.03E-11	2.00E-03	1.51E-08
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	1.35E-11	2.90E-01	4.67E-11
n-propylbenzene	3.85E-11	2.90E-01	1.33E-10
p-cymene	2.34E-12	1.00E-01	2.34E-11
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	2.08E-10	1.00E-02	2.08E-08
trichloroethene	2.48E-10	7.35E-03	3.37E-08
xylenes	2.58E-11	2.00E-01	1.29E-10
	HQ Summation =		1.2E-06

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	4.27E-09	NA	NA
1,2,4-trimethylbenzene	4.48E-12	NA	NA
1,3,5-trimethylbenzene	1.30E-11	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	5.80E-12	NA	NA
n-propylbenzene	1.65E-11	NA	NA
p-cymene	1.00E-12	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	8.90E-11	2.10E-02	1.87E-12
trichloroethene	1.06E-10	1.00E-02	1.06E-12
xylenes	1.11E-11	NA	NA
	ILCR Summation =		2.9E-12

Table B-27
Summary of Potential Health Effects
Off-Site RME Resident Child

Exposure Pathway	Receptor Hazard Quotient
Inhalation of Outdoor Air	5.5E-06
Total Population Hazard Quotient =	5.5E-06

Exposure Pathway	Receptor Incremental Lifetime Cancer Risk
Inhalation of Outdoor Air	2.7E-12
Total Population Incremental Lifetime Cancer Risk =	2.7E-12

Table B-28
Summary of Risk Quantitation
Off-Site RME Resident Child
Via Inhalation of Outdoor Air

Intake Equation = $\frac{CS \times EF \times ED \times ET \times IR}{BW \times AT}$

IR	Inhalation rate of gases (RAGS, 1989)	0.83	m3/h
EF	Exposure frequency	350	days/year
EDn	Exposure duration for non-carcinogens	6	year
EDc	Exposure duration for carcinogens	6	year
BW	Body weight	15	kg
ATc	Average time for carcinogens (lifetime)	25550	days
ATn	Average time for non-carcinogens (EDn x 365)	2190	days
ET	Exposure time	24	h/d
Ci	Concentration of chemicals Outdoors	(see Table 5-6)	

Chemical Concentrations

Compound	Concentration (mg/m3)
1,1-dichloroethene	3.65E-08
1,2,4-trimethylbenzene	3.83E-11
1,3,5-trimethylbenzene	1.11E-10
aroclor 1248	NA
aroclor 1254	NA
aroclor 1260	NA
arsenic	NA
benzo(a)anthracene	NA
benzo(a)pyrene	NA
benzo(b)fluoranthene	NA
benzo(k)fluoranthene	NA
bis(2-ethylhexyl)phthalate	NA
chrysene	NA
dibenzo(a,h)anthracene	NA
fluoranthene	NA
indeno(1,2,3-cd)pyrene	NA

Compound	Concentration (mg/m3)
naphthalene	NA
n-butylbenzene	4.96E-11
n-propylbenzene	1.41E-10
p-cymene	8.57E-12
phenanthrene	NA
pyrene	NA
tetrachloroethene	7.61E-10
trichloroethene	9.09E-10
xylenes	9.47E-11

Table B-28 (cont.)
Summary of Risk Quantitation
Off-Site RME Resident Child
Via Inhalation of Outdoor Air

	Non-Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	RfD (mg/kg-d)	HQ (unitless)
1,1-dichloroethene	4.65E-08	9.00E-03	5.16E-06
1,2,4-trimethylbenzene	4.88E-11	2.00E-03	2.44E-08
1,3,5-trimethylbenzene	1.41E-10	2.00E-03	7.07E-08
aroclor 1248	NA	7.00E-05	NA
aroclor 1254	NA	7.00E-05	NA
aroclor 1260	NA	7.00E-05	NA
arsenic	NA	3.00E-04	NA
benzo(a)anthracene	NA	4.00E-02	NA
benzo(a)pyrene	NA	4.00E-02	NA
benzo(b)fluoranthene	NA	4.00E-02	NA
benzo(k)fluoranthene	NA	4.00E-02	NA
bis(2-ethylhexyl)phthalate	NA	2.00E-02	NA
chrysene	NA	4.00E-02	NA
dibenzo(a,h)anthracene	NA	4.00E-02	NA
fluoranthene	NA	4.00E-02	NA
indeno(1,2,3-cd)pyrene	NA	4.00E-02	NA
naphthalene	NA	4.00E-02	NA
n-butylbenzene	6.32E-11	2.90E-01	2.18E-10
n-propylbenzene	1.80E-10	2.90E-01	6.19E-10
p-cymene	1.09E-11	1.00E-01	1.09E-10
phenanthrene	NA	3.00E-01	NA
pyrene	NA	3.00E-02	NA
tetrachloroethene	9.69E-10	1.00E-02	9.69E-08
trichloroethene	1.16E-09	7.35E-03	1.57E-07
xylenes	1.21E-10	2.00E-01	6.03E-10
	HQ Summation =		5.5E-06

	Carcinogenic Calculation		
Compound	CDI (mg/kg-d)	CSF (mg/kg-d)-1	ILCR (unitless)
1,1-dichloroethene	3.98E-09	NA	NA
1,2,4-trimethylbenzene	4.18E-12	NA	NA
1,3,5-trimethylbenzene	1.21E-11	NA	NA
aroclor 1248	NA	7.70E+00	NA
aroclor 1254	NA	7.70E+00	NA
aroclor 1260	NA	7.70E+00	NA
arsenic	NA	1.20E+01	NA
benzo(a)anthracene	NA	3.90E-01	NA
benzo(a)pyrene	NA	3.90E+00	NA
benzo(b)fluoranthene	NA	3.90E-01	NA
benzo(k)fluoranthene	NA	3.90E-01	NA
bis(2-ethylhexyl)phthalate	NA	8.40E-03	NA
chrysene	NA	3.90E-02	NA
dibenzo(a,h)anthracene	NA	4.10E+00	NA
fluoranthene	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	3.90E-01	NA
naphthalene	NA	NA	NA
n-butylbenzene	5.41E-12	NA	NA
n-propylbenzene	1.54E-11	NA	NA
p-cymene	9.35E-13	NA	NA
phenanthrene	NA	NA	NA
pyrene	NA	NA	NA
tetrachloroethene	8.31E-11	2.10E-02	1.74E-12
trichloroethene	9.92E-11	1.00E-02	9.92E-13
xylenes	1.03E-11	NA	NA
	ILCR Summation =		2.7E-12

BOE-C6-0058628

INTEGRATED
Environmental Services, Inc.

March 6, 1998

Via Federal Express

Karen Baker
California Environmental Protection Agency
Department of Toxic Substances Control
Hazardous Waste Management Program
245 West Braodway, Suite 425
Long Beach, CA 90802

SUBJECT: **POST-DEMOLITION RISK ASSESSMENT**
BOEING C-6 FACILITY, PARCEL A, LOS ANGELES, CALIFORNIA

Dear Ms. Baker:

On behalf of Boeing Realty Corporation, Integrated Environmental Services Inc. is pleased to submit for your review the attached document pertaining to the C-6 facility, Parcel A. We are delighted to report that the incorporation of DTSC's review comments has resulted in a reduction of projected risks.

As detailed in the report, the findings depend on the agreed upon removal of the eight arsenic hot spots. Confirmation sampling will be conducted in accordance with the site sampling and analysis plan, and results will be provided to your office as soon as available.

A response document has been included to address each of the comments issued by Dr. Oudiz. Furthermore, the report has been prepared in revision mode to highlight all changes from the previous submission. New text has been underlined. Revision bars appear in the right margin to indicate either an addition or deletion.

Thank you for your guidance on this important project. I look forward to discussing the details with you. Please contact me at (714) 813-8568 if you need further information.

Very truly yours,

Chris Stoker
Program Manager

cc: D. Oudiz, DTSC HERD
J. Ross, RWQCB-LA
S. M. Stavale, Boeing

encl: 1 copy, 6 books

3990 Westerly Place, Suite 210 ◆ Newport Beach, CA 92660 ◆ Tel: (714) 852-9050 ◆ Fax: (714) 852-9011

INTEGRATED
Environmental Services, Inc.

Post-Demolition Risk Assessment

Boeing Realty Corporation
C-6 Facility, Parcel A

Los Angeles, California
March 6, 1998

Prepared by

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for

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RESPONSE TO COMMENTS

IN
MEMORANDUM DATED FEBRUARY 26, 1998
FROM CAL/EPA DEPARTMENT OF TOXIC SUBSTANCES CONTROL
REGARDING
POST-DEMOLITION RISK ASSESSMENT, BOEING C-6 FACILITY, PARCEL A
LOS ANGELES, CALIFORNIA (FEBRUARY 1998)

General Comments

Parcel A has been extensively and thoroughly characterized and the soil sampling data presented in the Phase II Soil Characterization document appear to be adequate and appropriate for use in the risk assessment. HERD assumes that both DTSC and the LARWQCB have evaluated these data and that the data meet all criteria for QA/QC. DTSC regional staff have not reviewed the soil confirmation reports (MW 1997a, 1997b, 1997c, 1997d, 1997e), and HERD has not received the documents. We recommend that the LARWQCB review these documents if they have not done so already. For the most part, the data presented in the Phase II Soil Characterization do not suggest that there are extremely contaminated areas in Parcel A. The current human health risk assessment (HRA) predicts relatively low cancer risks (below 10E-06) and hazard indices (HI) below 1 for the exposure scenarios evaluated in the main portion of the text (page 6-11). While HERD has a number comments on the risk assessment procedures, we do not anticipate that risk estimates will be elevated to levels which would pose a significant risk, with a few notable hot spot exception (see General Comment 3). The recalculated risks may be in the range of 1×10^{-5} cancer risk. The following are major concerns which need to be addressed in any revised document. Specific Comments are included in the next section.

Comment 1

The exposure scenarios are based upon a deed restriction for this property. DTSC/HERD do not know what the extent or content of this deed restriction will be, and therefore, we are at a disadvantage in reviewing the HRA. At various points in the HRA it is stated that a deed restriction will be instituted to presumably limit development to industrial uses; that the deed restriction will include prevention of water usage from underlying aquifers; and that agricultural use of the land will be prohibited. It is also implied that since the parcel is designated industrial use, that it will be paved and direct soil contact exposures will be eliminated for certain exposure scenarios. It is not clear if a maintained cap is proposed as a part of the deed restriction, or if this is just a future use assumption. If a maintained cap is not included in the deed restriction, it cannot be assumed that one will exist under all property uses in the future. Clarification on the content and extent of the deed restriction are needed in order to support the assumptions in the HRA.

Response 1

As documented in the post-demolition risk assessment, the deed restrictions for Parcel A have not been completed. These deed restrictions will limit future development to light commercial/industrial use. In addition, these deed restrictions will prohibit the development of domestic or production wells on the property. These two constraints are the only deed restrictions assumed in the post-demolition risk assessment. Other assumptions, such as the use of clean, imported fill material are not controlled under the proposed deed restrictions.

While it is acknowledged that provisions for maintaining the clean-fill layer are not incorporated into the deed restrictions and thus cannot eliminate direct exposures, it is also recognized that this imported material would significantly reduce the likelihood of exposure under non-intrusive conditions. It is these non-intrusive conditions that future site users have the highest probability of encountering. Therefore, Integrated and DTSC have agreed to provide an intrusive commercial/industrial scenario and a non-intrusive commercial/industrial scenario. This provides the anticipated range of possible risks without provisions for maintenance of the clean-fill layer.

Comment 2

The only sampling data that are presented in the HRA are the log 95%UCL and maximum concentrations for chemicals of potential concern (COPCs). It is stated on pages 2-2 and 2-3 that soil data for the HRA were taken from the Phase II Soil Characterization (July 1997) and from soil confirmation reports (MW 1997a, 1997b, 1997c, 1997d, 1997e). DTSC and HERD have not reviewed the soil confirmation reports which the HRA data were, in part, based. The HRA document must be sufficiently complete to support the risk analyses contained in it. In order to accomplish this, a summary of data set on which the analyses are based on must be included in the document. At minimum this should include detection limits, minimum and maximum detections, arithmetic mean, 95%UCL (if sufficient number of samples), depth and location of samples. Currently, HERD does not know which data were used for the calculation of risks on Parcel A. A complete set of the data used in the HRA should be made available to DTSC. In order to expedite review of the project, HERD requests that the data set used for the HRA be submitted in an electronic format so that it can be evaluated. Furthermore, HERD requests that DTSC regional staff review the HRA data base and verify the acceptability of the data.

Response 2

Appendix C has been added to the post-demolition risk assessment. This appendix summarizes all data found acceptable for use in the Parcel A risk assessment. Statistical summaries for all detected constituents have also been included.

Comment 3

HERD and IES agreed to use the background data from the neighboring site, International Light Metals (ILM) in order to determine which inorganic compounds are related to ambient (background) conditions and which may be related to contamination on Parcel A. At the time, we agreed to compare the background data with te95% UCL value of the site data set. This approach worked fairly well for most of the inorganic contaminants, identifying them as comparable to background concentrations; however, the approach did not identify what appears to be arsenic contamination on site. The Phase II Soil Characterization document reports 798 samples which were analyzed for arsenic. All but seven of these analyses were below the detection limit of 1 ppm. The seven detections were 12, 14, 36, 55, 90, 150, and 350. All arsenic hits were located in the southern leg on Normandy Avenue, and all except the 12 and 14 ppm hits were in the top 1 to 1.5 feet of soil. The other two hits were both at four feet. It is apparent that the large number of nondetect data points obscured an area with arsenic contaminated soil. The highest hit of arsenic is three orders of magnitude above the USEPA Region IX Residential PRG, and considerably above the background data point cited for the ILM data set. The arsenic values above 14 ppm are considered elevated and attributable to contamination on the site. Arsenic should be added to the COPC list and, where clearly elevated above background, evaluated for risks. The arsenic contamination appears to be localized to the one section, and it may be appropriate to evaluate arsenic as a COPC only for the AOPC (see General Comment 4 for a discussion of AOPCs).

Several of the other metals had maximum concentrations above the background value (log 95% UCL was below the background), but they did not appear as skewed as the arsenic data, with the exception of beryllium. The maximum concentration for beryllium was reported to be 100 ppm, but this value was not reported in the Phase II Soil Characterization report. When the entire data set is received, this discrepancy may be explained.

The entire background data set should be included in the HRA. HERD recommends that other evaluations be considered in the determination of background concentrations in future documents. These may include graphic representation of the distributions, summary statistics, maximum concentrations comparisons, and the Wilcoxon Rank Sum Test. HERD does not necessarily require this for Parcel A at this time if the question of beryllium can be answered and if arsenic is included as a COPC.

Response 3

DTSC and Integrated have revised the selection process for inorganic COPCs to ensure that all detected Class A carcinogens (i.e., arsenic) are included in the post-demolition risk assessment. Furthermore, DTSC and Integrated have agreed that all arsenic hot-spots in AOPC 2 exceeding background should be removed from the site. These sample locations were identified for remediation based on their shallow sample depth and elevated concentrations. The deeper arsenic concentrations found in AOPC 1 will be included in the post-demolition risk assessment. The findings of the risk assessment will determine the necessity for further arsenic remediation.

As presented in response 2, the requested data set has been provided.

Comment 4

HERD and IES agreed to divide Parcel A into smaller areas of localized contamination for the purposes of the HRA. The Areas of Potential concern (AOPC) were defined by plotting soil data that were above the USEPA Region IX Residential PRGs and visually determining boundaries for these areas. In Figure 5-1, IES defined two AOPCs. One of these areas contained a cluster of semi-volatile compounds, and the other AOPC encompassed the balance of Parcel A. DTSC/HERD disagrees with the division and suggests that AOPC 2 be divided into three AOPCs, in addition to AOPC 1. Proposed AOPC2 would be the southern leg of Parcel A along Normandie Avenue (including WCC-8s); proposed AOPC3 should be the narrow strip from Normandie Avenue along area near WCC-3D to just east of WCC-2s; and proposed AOPC 4 should be the remainder of Parcel A. The proposed AOPC 2 would contain the elevated arsenic samples, which are not included in Figure 5-1.

Response 4

DTSC and Integrated evaluated further divisions of AOPC 2 to ensure that exposure point concentrations were not biased as a result of statistical dilution. DTSC and Integrated have agreed that the findings of this analysis indicate no significant difference in exposure point concentrations with further AOPC designations.

Specific Comments

Comment 1

Table 2-1: Many of the USEPA Region IX Residential PRGs do not agree with the August 1, 1996 PRG list. A more current list has not been officially released by USEPA, and HERD has not reviewed any changes to the PRGs from the 1996 list. Furthermore, industrial PRGs were substituted for a number of the residential PRGs. The PRG for Aroclor 1254 on page 2-12 of Table 2-1 should be for the carcinogenic effects, not the noncancer effect. When this PRG is used, this compound should be included as a COPC. Additionally, when the correct PRG is used for indeno(1,2,3-cd)pyrene, this compound should also be included in the COPC list. Correction of the PRGs may also affect the distribution contaminants for the visual determination of the AOPCs.

Response 1

The PRG values in Table 2-1 have been reviewed and modified as necessary. This has added aroclor 1254, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene to the COPC list. The modification of PRGs did not impact the visual determination of the AOPCs.

Comment 2

Page 3-1: While the Potency Equivalency Factors (PEFs) for PAHs quoted in Wade 1994 are correct, it is more appropriate to cite the source of the PEFs, Cancer Potency Factors List (CalEPA/OEHHA 1994). Additionally, these values must be included in the risk assessment and clearly stated how they are being applied, i.e. whether it is an adjustment in the cancer slope factor or the exposure intake.

Response 2

The reference has been changed accordingly.

Comment 3

Table 3-1: A number chronic inhalation RfDs were incorrect and should be changed to the following values:

trimethylbenzenes	*0.002 mg/kg-day*
naphtalene	*0.04 mg/kg-day*
n-butylbenzene	*0.29 mg/kg-day*
n-propylbenzene	*0.29 mg/kg-day*
p-cymene	*0.1 mg/kg-day*
xylene	*0.2 mg/kg-day*

These values should also be checked in the spreadsheets in Appendices. Several incorrect values were carried over into the hazard indices calculations. Reference sources for each of the RfDs should be indicated on the table, not as a general footnote at the bottom.

Response 3

The original chronic inhalation toxicity values provided by DTSC were referenced as RfC values, thus requiring adjustment. As noted in the comment, these values should have been referenced as RfDs thereby requiring no further adjustment. Corrections have been made as appropriate, and reference sources have been added for each RfD.

Comment 4

Table 3-1: The nocancer effects of carcinogens should also be considered. The following RfDs should be used for both oral and inhalation exposures:

PAHs	*0.04 mg/kg-day (surrogate value)*

TCE 7.35E-3 mg/kg-day (DTSC calculated value)
PCBs 7.0E-05 mg/kg-day (surrogate value)
bis(2-ethylhexyl)phthalate 2.0E-02 mg/kg-day

Response 4

These values have been incorporated accordingly.

Comment 5

Table 3-2: Please include the inhalation CSFs for the PAHs. The only CSFs that are correct on this table are the ones for the aroclors and dibenzo(a,h)anthracene. Other values are transposed between the oral and inhalation values or wrong. Please check this table and check tables in the Appendices. It should also be indicated that the PAH CSFs are based on benzo(a)pyrene. If PEF adjustments are made on this or other tables, they should be noted.

Response 5

The values in Table 3-2 have been reviewed and corrected.

Comment 6

Table 3-3 and page 3-8: HERD generally doesn't correct the oral cancer slope factors (CSF) for gastrointestinal absorption and calculate a separate dermal CSF. This correction tends to unrealistically increase the risks from dermal exposures unless accurate data are present documenting absorption by both pathways. HERD intended its earlier recommendation in the 11/3/97 memorandum to include both RfDs and CSFs.

Response 6

Table 3-3 has been removed from the document, and page 3-8 has been modified to present HERD's current position on RfDs and CSFs.

Comment 7

Figure 4-1: All complete exposure pathways should be included in the risk assessment. Several of the pathways were listed as insignificant and later dropped from the risk assessment. In particular, the inhalation pathway for VOCs from groundwater was eliminated on pages 4-14 and 5-17 without supporting documentation. Technical justification for determining that his pathway should be eliminated should be incorporated into the document.

Response 7

The insignificant pathways presented in Figure 4-1 have been previously agreed upon by DTSC and Boeing. These insignificant pathways have been footnoted in the document for clarification.

Comment 8

Figure 4-1 and page 4-14: The exposure parameters for the construction worker and industrial/commercial worker scenarios were addressed in the November 3, 1997 and January 29, 1998 memoranda from Dr. Deborah Oudiz to Karen Baker. While these memoranda addressed the draft Health Based Remedial Goals (which were not approved or finalized), IES discussed using the protocols as a workplan for the current risk assessment. In the 11/3/97 memorandum, the exposure frequency for the construction worker was set at 250 days/year with a one year exposure duration. This scenario was also designed to address an intrusive maintenance worker scenario.

During the February 9, 1998 meeting in Sacramento with IES, it was agreed that the commercial/industrial scenario would include direct soil contact exposure pathways, including ingestion, dermal, and inhalation. Standard exposure assumptions apply, except for the following revised exposure parameters:

Exposure frequency = 125 days/year

Skin surface area = 2020 cm^2

The commercial/industrial scenario in the main body of the document only considered inhalation of VOCs in outdoor and indoor air. The exposure scenario, which was requested by HERD, is in Appendix C. HERD strongly believes that these belong in the body of the document and any risk management decisions should be based on the complete exposure scenarios. While we understand that the proposed development of Parcel A includes paving and landscaping all areas outside of buildings, there are no assurances that future use of the land will present different property developments and exposures. Unless a maintained cap is written into the deed restriction, all reasonable long term industrial uses of the property must be considered. When HERD determines that residual contamination on a property does not present significant health risk, it must include the possibility that the soil may not be capped. Direct contact exposures to commercial/industrial workers must be assessed, including ingestion, dermal, and inhalation of vapors and particulates.

In addition, the offsite worker and resident exposure scenario should include inhalation exposure to contaminated particulates from the site.

Response 8

The exposure parameters for all receptors were modified and submitted to DTSC on February 28, 1998, for review and approval. These agreed upon exposure parameters have been incorporated into the latest version of the risk assessment.

The commercial/industrial worker previously addressed in Appendix C has been incorporated into the main body of the document.

Particulate exposures to the on-site construction worker and commercial/industrial worker were found to be insignificant. Exposures to these on-site receptors are significantly greater than exposures to off-site receptors; therefore, exposures to off-site receptors were not evaluated.

Comment 9

Tables 4-1, 4-2, and 5-3: Chemical specific parameters from the Soil Screening Guidance: Technical Background Document (USEPA, May 1996) should be preferentially used for any chemical for which there are data. This was requested in the November 3, 1997 memorandum from Dr. Oudiz to Karen Baker. It is not necessary to change the parameters for this assessment, but all future documents should contain the values from the SSL document.

Response 9

Comment noted.

Comment 10

Page 5-2: IES has identified the 0 - 50 ft interval for fate and transport modeling for the air emissions, which HERD agrees with. In addition, the 1-12 ft interval was identified for direct exposure pathways. HERD generally only considers the top 10 feet for direct exposure pathways for residential scenarios, and may consider even shallower depths for industrial exposure scenarios depending upon site specific conditions. IES and Boeing are aware of our approach and have elected to evaluate the soils to depth of 12 feet for direct soil contact exposure pathways.

Response 10

Comment noted.

Comment 11

Page 5-4: Statistical summaries, statistical tests, and other pertinent information is alluded to in this section. These analyses and data summaries should be presented in the document. (See General Comment 2)

Response 11

Statistical and analytical data are presented in Appendix C.

Comment 12

Page 5-5: The calculation of the log 95%UCL must be documented and the equations and input parameters must be in the text. The formulas and calculations should follow the Supplemental Guidance to RAGS: Calculating the Concentration Term (USEPA, May 1992)

Response 12

The GIS Key Statistical Modules Users Guide is presented in Appendix D.

Comment 13

Page 5-19: It is stated that site conditions indicate that transport is governed by diffusive conditions. Please be more specific in the text and substantiate the statement.

Response 13

The Peclet calculations for the determination of transport conditions are presented in Appendix E.

Comment 14

Table 5-6: The particulate emissions should be modeled and added to this table in order to address inhalation pathways. (See Specific Comment 7)

Response 14

As stated in Response 8, particulate emissions do not represent significant exposures to off-site receptors.

Comment 15

Page 5-26: The values for the parameters in equation 5-15 need to be presented in the text.

Response 15

The values for the parameters in equation 5-15 are defined in the text.

Comment 16

Page 5-26: Please present the other equations used to calculate indoor air concentrations after equations 5-14 and 5-15.

Response 16

The text has modified accordingly showing the calculation of indoor air concentrations.

Comment 17

Table 6-2: This table should be corrected with the exposure parameter values outlined in Specific Comment 7 and additional exposure pathways must be added to the commercial/industrial worker and offsite scenarios.

Response 17

Table 6-1 was revised and submitted to DTSC for concurrence. As stated in Response 8, the additional exposure pathways to off-site receptors are insignificant.

Comment 18

Page 6-4 and COPC Intake and Risk Calculation Sheets: Inhalation intake estimates and risks from outdoor (ambient) exposures and indoor exposures should be calculated and presented separately. In order for HERD to determine the relative contributions of each pathway to the overall risk, each pathway must be presented separately. Furthermore, HERD recognizes that IES has essentially double counted the soil emissions into air by assuming that all of the emissions are present in both the ambient air and indoor air. HERD also understands the limitations and conservative estimates that are inherent in the indoor air models. Emissions and risks estimated from these models are used to assess both the necessity of potential remediation strategies as well as to indicate where further investigations are needed. If high risks are predicted for indoor air contamination, HERD will often recommend real time monitoring of structures in order to evaluate the actual emissions in a building. The indoor air emissions are evaluated using scientific judgment and perspective in determining the need for potential remediation on a site.

Response 18

Outdoor and indoor exposures have been presented in separate calculations. However, indoor air concentrations reflect vapor intrusion plus outdoor air introduction through ventilation. Indoor air risks projected at the site are dominated by air introduced through the ventilation system. The air entering through the floor (vapor intrusion) is insignificant.

Comment 19

Page 6-8: DTSC/HERD considers 1 x 10^{-6} cancer risk estimate to be a point of departure and the risk management range to be 1 x 10^{-4} to 1 x 10^{-6}. The acceptable risk range for a site is the prerogative of the regulating agency and a determination of what value should be established as the significant risk level by IES is not appropriate. HERD considers an HI greater than 1 to be of potential concern, not an HI of 10 as stated in the document. If the HI is at unity, further investigation and evaluation may be warranted, and remedial alternatives may be considered.

Response 19

Text has been modified for clarification, and the reference to an HI of 10 has been removed.

Comment 20

Page 6-11: While it is agreed that a number of HQ's are added which have different organ endpoints, the summation of HQ's also addresses other concerns of multiple chemical exposure. Chemical interactions, the affect of one compromised organ system on the functioning of other organ systems, and multiple insults to systems not well understood, such as the immune system, are at least recognized by the additivity of both noncancer HQ and cancer risks.

Response 20

Comment noted.

Comment 21

Table 6-3: Regulatory maximums should be eliminated from this table since they infer risk management decisions by IES and regulatory actions by DTSC and the LARWQCB.

Response 21

Reference to "regulatory maximums" has been eliminated.

SIGNATURES

POST-DEMOLITION RISK ASSESSMENT

BOEING REALTY CORPORATION C-6 FACILITY, PARCEL A

LOS ANGELES, CALIFORNIA

MARCH 6, 1998

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TABLES

ACRONYMS

ALCOA	Aluminum Company of America
AOPC	areas of potential concern
BRC	Boeing Realty Corporation
BTEX	benzene, toluene, ethylbenzene, xylene
Cal/EPA	California Environmental Protection Agency
CAO	Cleanup and Abatement Order
CDI	chronic daily intake
CDM	Camp Dresser McKee
CEM	conceptual exposure model
COPC	constituent of potential concern
CLP	Contract Laboratory Program
CSF	cancer slope factor
CSV	chemical specific value
DAC	Douglas Aircraft Company
DCA	dichloroethane
DCE	dichloroethene
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EHP	Electronic Handbook Publishers
EHRAV	Environmental Handbook of Risk Assessment Values
EPA	Environmental Protection Agency (U.S.)
G&M	Geraghty & Miller, Inc.
GC/MS	gas chromatography/mass spectography
GI	gastrointestinal
HBRG	health-based remediation goal
HEAST	Health Effects Assessment Summary Tables
HERD	Human and Ecological Risk Division
HI	hazard index
HQ	hazard quotient
HSDB	Hazardous Substance Data Base
IARC	International Agency for Research on Cancer
ICP/GFAA	Inductively Coupled Plasma/Graphite Furnace Atomic Analyses
IESI	Integrated Environmental Services, Inc.
ILCR	incremental lifetime cancer risk
IRIS	Integrated Risk Information System
ISC2	Industrial Source Complex 2 (Model)
ISCST3	Industrial Source Complex Short-Term 3 (Model)

JMM	James M. Montgomery Consulting Engineers
K/J	Kennedy/Jenks Consultants
LOAEL	lowest-observable-adverse-effect level
LOD	limit of detection
LOQ	limit of quantitation
MW	Montgomery Watson
NIOSH	National Institute of Occupational Safety and Health
NOAEL	no-observable-adverse-effect level
NLM	National Library of Medicine
NPC	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OSWER	Office of Solid Waste Emergency Response
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEF	potency equivalence factor
PID	photo-ionization detector
POE	point of exposure
PRG	preliminary remediation goal
QA/QC	quality assurance/quality control
RAGS	Risk Assessment Guidance for Superfund
RfC	reference concentration
RfD	reference dose
RI/FS	remedial investigation/feasibility study
RME	reasonable maximum exposure
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SCAQMD	South Coast Air Quality Management District
SEAM	Superfund Exposure Assessment Model
SRC	Syracuse Research Corporation
SVOC	semi-volatile organic compound
TCA	trichloroethane
TCE	trichloroethylene
TOXNET	Toxicology Data Network
TPH	total petroleum hydrocarbon
TRPH	total recoverable petroleum hydrocarbon
UCL	upper confidence limit
UST	underground storage tank
VOC	volatile organic compound
WCC	Woodward-Clyde Consultants

SECTION 1

INTRODUCTION

1. INTRODUCTION

This Post-Demolition Risk Assessment was developed to evaluate the health protectiveness of post-demolition site conditions at Parcel A of the Boeing C-6 facility in Los Angeles, California. Specifically, does Parcel A adequately protect the health of future users? Also, what are the health impacts, if any, associated with redevelopment of the parcel as a commercial/industrial facility?

The 170-acre C-6 facility (Figure 1-1) has been used since the 1940s for industrial purposes but is currently undergoing a phased demolition and redevelopment. During each phase of the project, a post-demolition risk assessment will be conducted for the parcel undergoing redevelopment.

This risk assessment was prepared following the procedures and methodologies described in relevant guidance documents from the California Environmental Protection Agency (Cal/EPA) and U.S. Environmental Protection Agency (EPA). The objective, scope, and key assumptions presented have been discussed with and agreed to by the lead regulatory agency for the C-6 site, the California Regional Water Quality Control Board - Los Angeles Region (RWQCB-LA), and the lead agency for health risk, the Cal/EPA Department of Toxic Substances Control (DTSC).

1.1 OBJECTIVE AND SCOPE

The primary objective of this risk assessment is to evaluate the potential health risks to future users of the redeveloped parcel and to identify any localized "hot spots" requiring remediation (Cal/EPA 1997). As mentioned, exposures and associated risks are estimated assuming the construction and daily use of the parcel as a light commercial/industrial facility. This scenario and associated site conditions were developed in accordance with Boeing's proposed deed restrictions for Parcel A.

FIGURE 1-1
BOEING C-6 SITE, LOS ANGELES, CA

By agreement with RWQCB and DTSC, this risk assessment focuses on the potential health impacts posed by Parcel A soils. Based on the extensive amount of site data collected in the past 10 years, and the proposed deed restrictions, groundwater is unlikely to present significant exposures to current or future users and is not considered a health issue. Groundwater will be addressed separately, under RWQCB guidance.

As health-protective, upper-bound estimates of risk, the findings of this risk assessment will enable the site owner and regulatory agencies to assess the magnitude of potential risks associated with Parcel A and to formulate a health-protective and cost-efficient exit strategy. As such, the findings are a vital risk-management tool for the agencies and current and future stakeholders.

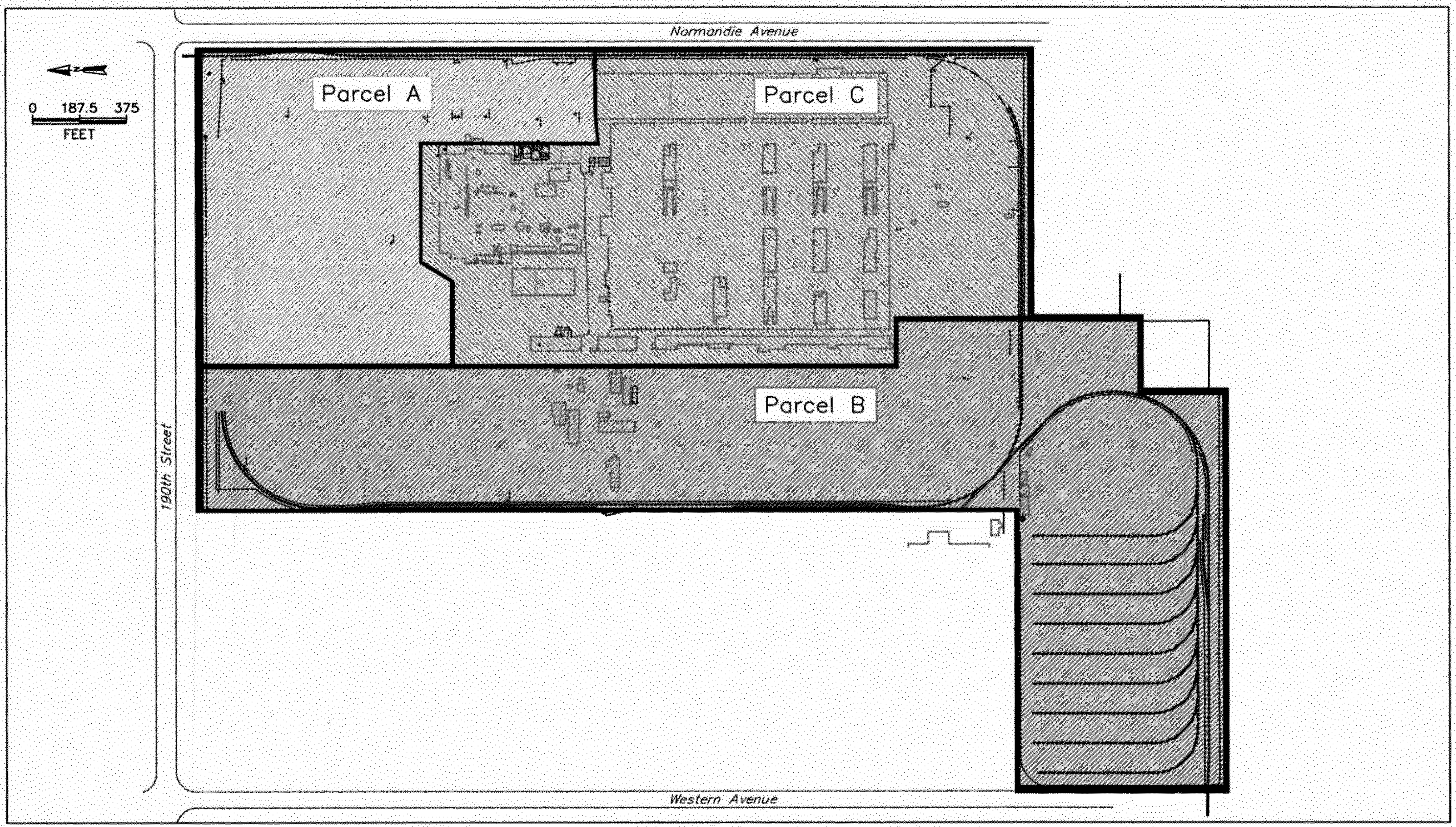
1.2 SITE DESCRIPTION AND OPERATIONAL HISTORY

The C-6 facility (Figure 1-1) is located at 19503 South Normandie Avenue in Los Angeles, California, and is bordered by 190th Street to the north, Normandie Avenue to the east, 203rd Street to the south, and Western Avenue to the west. As shown in Figure 1-2, Parcel A fronts both 190th Street and Normandie Avenue.

Aerial photographs indicate that the area was farmland prior to the 1940s. Industrial use of the property began in 1941 when the Defense Plant Corporation (PLANCOR) developed the site as part of an aluminum reduction plant. The Aluminum Company of America (ALCOA) operated the plant for the government to produce aluminum during World War II. Five "pot lines" were originally constructed at the plant, but only three were placed in operation. ALCOA operated the plant until it was closed in September 1944 (CDM 1991).

The War Assets Administration then used the site for temporary storage during the following two years. In 1948, Columbia Steel Company purchased the property. No significant changes were made to the plant under Columbia Steel Company ownership (CDM 1991).

In March 1952, the US Navy purchased the property and established the Douglas Aircraft Company (DAC) as the contractor and operator of the facility for the manufacture of aircraft parts. DAC purchased the property from the Navy in 1970 and used the facility to manufacture components for various commercial and military aircraft until approximately 1992. Since cessation of manufacturing activities, DAC has used the C-6 facility to store and distribute aircraft parts (K/J 1996a, 1996b, 1996c).



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INTEGRATED Environmental Services, Inc.

TITLE:	DWN: JL	DES.: JL	PROJECT NO.: Boeing C-6 Parcel A
Boeing C-6 Facility Parcels A, B, and C	CHKD: JH	APPR: MY	
	DATE: 3-6-98	REV.: 1	FIGURE NO.: 1-2

BOE-C6-0058653

Boeing Realty Corporation became the site operator responsible for cleanup in August 1997, when its corporate parent, the Boeing Company, acquired McDonnell Douglas. Boeing is working with multiple agencies on C-6 closure and redevelopment. In addition to RWQCB-LA and DTSC, the South Coast Air Quality Management District (SCAQMD) and the City of Los Angeles are involved.

Table 1-1 summarizes the land-use history of the C-6 property.

TABLE 1-1
LAND-USE HISTORY

Period	Land Use	Operator/Owner
Before 1941	Farmland	
1941-44	Aluminum reduction complex	ALCOA for Defense Plant Corp.
1944-48	Warehousing	War Assets Administration
1948-52	Warehousing	Columbia Steel Company
1952-70	Manufacture of aircraft parts	Douglas Aircraft Co. for U.S. Navy
1970-92	Manufacture/assembly of aircraft components	Douglas Aircraft Co.
1992-Pres.	Storage/distribution of aircraft spares, Storage of production line material and tooling	Douglas Aircraft Co. for McDonnell Douglas (now Boeing)
1996-Pres.	Site investigation, demolition and redevelopment	Boeing Realty Corp. (formerly McDonnell Douglas Realty Co.)

SOURCE: Boeing

1.3 SITE CHARACTERIZATION STUDIES

Since the mid-1980s, the C-6 facility has undergone several site characterization studies. To date, the most thorough investigations of Parcel A have been the Phase I environmental assessment and Phase II soil characterization studies conducted by Kennedy/Jenks Consultants in 1996 and 1997 (K/J 1996a and K/J 1997). These assessments and other important investigations of the entire C-6 site are summarized below. For the site-wide studies, only information pertaining to Parcel A is discussed. For the Parcel A Phase I study, only soils data are discussed.

Initial and Phase I Studies

Woodward-Clyde Consultants conducted the first investigations of the C-6 facility during its underground storage tank (UST) management program (WCC 1987). Elevated levels of organic compounds were reported, indicating the soil had been impacted by leaks from the tanks.

After this initial round of soil sampling, Woodward-Clyde and James M. Montgomery Consulting Engineers conducted expanded investigations of the area (WCC 1990 and JMM 1992). The key results of these studies can be summarized as follows:

- Tank 15T was the suspected source of the contamination.
- Three classes of organic compounds were detected in the soil - aromatics, chlorinated hydrocarbons, and ketones.
- The most prevalent hydrocarbons found were toluene, xylenes, TCA, and TCE.
- No solvents were detected in the surface soil (0 to 10 feet bgs).
- Elevated levels of organic compounds were detected in soil samples extending from 15 feet to groundwater (75 feet bgs).

The next major investigations occurred in preparation for the demolition and redevelopment of the C-6 facility: the Phase I environmental assessments of Parcels A, B, and C conducted by Kennedy/Jenks (K/J 1996a, 1996b, 1996c). These comprehensive assessments present areas within each parcel believed to be of environmental interest, including areas where contamination had already been detected, where chemicals were used or stored, where surface staining was visible, or where sumps, tanks, or clarifiers were located.

Parcel A Phase II Study

After the Phase I environmental assessments, Kennedy/Jenks conducted a Phase II soil characterization of Parcel A (K/J 1997). Under RWQCB supervision, 108 soil borings were installed and 550 soil samples collected and analyzed for volatile organic compounds (VOCs) and total recoverable petroleum hydrocarbon (TRPH). Selected additional analyses, including

Title 22 metals, polychlorinated biphenyls (PCBs), pesticides, and cyanide, were preformed on an area-by-area basis. Elevated levels of constituents were found in the following areas:

- Former Building 36, where elevated levels of 1,1-DCA, DCE, cis-1,2-DCE, TCA (at 20 feet bgs) and TCE (at 20 feet bgs) were detected. High concentrations of BTEX were also found at 20 feet bgs with toluene being the most prevalent aromatic hydrocarbon detected. Concentrations were found to be highest and have the widest lateral distribution between 20 to 40 feet bgs.

  Lithologic changes in this interval are believed responsible for the lateral distribution. Soil changes from mostly clay to primarily silts and even sand at this interval. The lateral extent of concentrations in excess of 500 ppb is limited to the area along the western side of the Building 36 footprint and north to the southern end of the Building 37 footprint.

- Former Building 66-1 Washdown Area, where TCE, ethylbenzene, xylenes and other VOCs were detected at 1 foot bgs.

- Northeastern Portion of Area 1, where lead was detected in two samples at 1 foot bgs but not at lower depths.

- Southern Portion of Supplemental Area Northeast, where concentrations of petroleum hydrocarbons were detected at 6 feet bgs, decreasing to non-detect below 10 feet bgs. The impacted soils are near a recently discovered pipeline that apparently led from two aboveground storage tanks originally used to store diesel fuel.

Excavations During Demolition

Investigation of Parcel A soils continued during the demolition of buildings and structures in 1997 and 1998 in an effort to identify any areas of soil contamination. Remedial excavation was conducted during demolition in accordance with the Sampling and Analysis Plan for Demolition Activities (IESI 1997a). A grid sampling approach was used to collect soil samples from freshly exposed areas in which building slabs, foundations, or other structures had been removed. A photo-ionization detector (PID) was used to determine concentrations of VOCs. Soils with a PID reading exceeded 5 ppm, or visible staining, or noticeable odors were excavated. Soils containing constituents at levels exceeding self-imposed health-based screening criteria (IESI 1997b) were excavated until sampling results indicated that screening criteria were met or until a depth of 12 feet was reached.

1.4 Current Conditions

McDonnell Douglas (now Boeing) began a phased redevelopment of the 170-acre C-6 property in 1996. Redevelopment of the northernmost portion of the property, Parcel A, began in 1996 and is ongoing. Parcels of the property impacted by each phase of the redevelopment will undergo, as required, environmental investigation, assessment, and excavation prior to construction.

Parcel A demolition is complete. All 9 buildings (725,000 square feet) have been razed, and the parcel has been graded for redevelopment. At the request of DTSC (IESI 1998b), three arsenic-impacted areas (containing eight hits) are being excavated and will be sent off site. It is important to note that this post-demolition risk assessment assumes these hot-spots will be remediated to background concentrations. Integrated and Boeing have agreed to perform confirmation sampling of these areas after remediation and provide the results to RWQCB and DTSC to substantiate the findings of this risk assessment. DTSC has agreed to this approach to allow for conditional approval of the risk assessment while the requested, limited arsenic removal progresses.

Almost 75 percent of the parcel (27.5 acres) has been sold and is awaiting agency approval of soil closure and title transfer. Before title transfer, 2 feet of clean, imported clayey soil will be placed over the 39.5 acres of Parcel A. This material is required to meet the specified grading conditions for the future site owner. However, the maintenance of this material will not be specified in the proposed deed restrictions. Therefore, this risk assessment estimates potential health effects both with and without the fill material.

1.5 Surrounding Land Use

The surrounding area is characterized by a mixture of industrial, commercial, and residential land uses. Two National Priority List (NPL) Superfund sites and one California Superfund site border the C-6 property, while three other known hazardous-waste-impacted sites are within a half mile (see Figure 1-3).

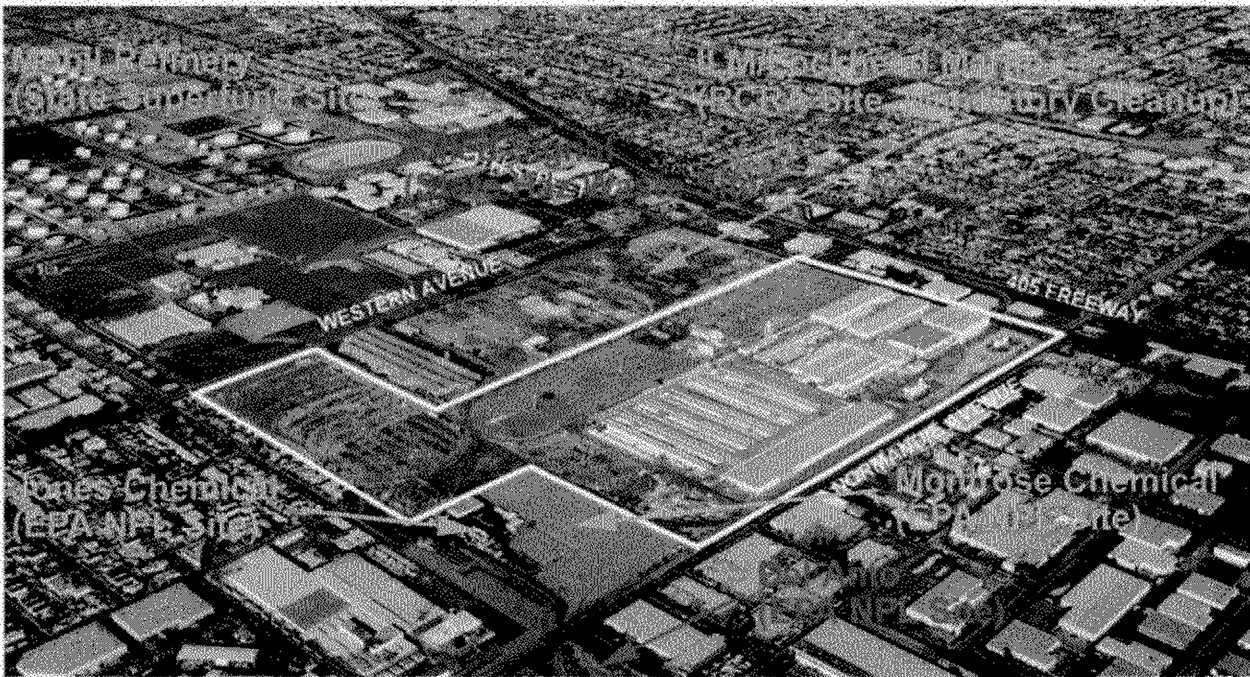

FIGURE 1-3
NEIGHBORING HAZARDOUS-WASTE-IMPACTED SITES

The C-6 property is currently zoned as heavy industrial (M3-1). The area north of the facility is zoned as light industrial (M2-1). The area to the south of the facility is zoned for commercial manufacturing; however, some residential single family homes and apartments are located there (CDM 1991).

Several of the properties adjacent to C-6 have undergone extensive environmental investigation and are known to have contributed to the regional contamination of groundwater in the area. The more environmentally significant properties include the Montrose Chemical, Lockheed Martin International Light Metals (ILM), and Del Amo sites.

Montrose Chemical, adjacent to the south side of the C-6 facility, is an NPL Superfund site. The site was used between 1947 and 1982 for the production of the pesticide DDT. The Montrose facility was dismantled in 1985 (CDM 1991). An environmental cap now covers the entire site. Potential future uses of the property are unknown.

The Lockheed Martin ILM facility, adjacent to the west of C-6, was used between 1946 and 1992 for metals production. The types of wastes produced at the site include waste TCA and petroleum-based solvents, waste oils, and PCBs (K/J 1994). All structures at the facility have been razed, and the top 10 feet of soil have been remediated under DTSC supervision. Redevelopment of the property is underway.

The Del Amo NPL Superfund site is 1500 feet east of C-6, across Normandie Avenue. Between 1942 and 1969 the site was used to manufacture synthetic rubber (K/J 1994d). Aqueous sludges produced during manufacturing operations were disposed on site in three large, shallow evaporation ponds and six sumps. The ponds contained high levels of polynuclear aromatic hydrocarbons (PAHs) and lower levels of VOCs (CDM 1991). The Del Amo site is currently under EPA jurisdiction, and remedial investigations are underway (K/J 1996a, 1996b, 1996c).

1.6 Risk Assessment Methodology

As discussed, this post-demolition risk assessment evaluates the potential health impacts to human receptors associated with post-demolition site conditions at Parcel A and the proposed development of the parcel as a commercial/industrial facility. As shown in Figure 1-4, the risk-estimation methodology consists of six distinct steps, some of which may be performed concurrently.

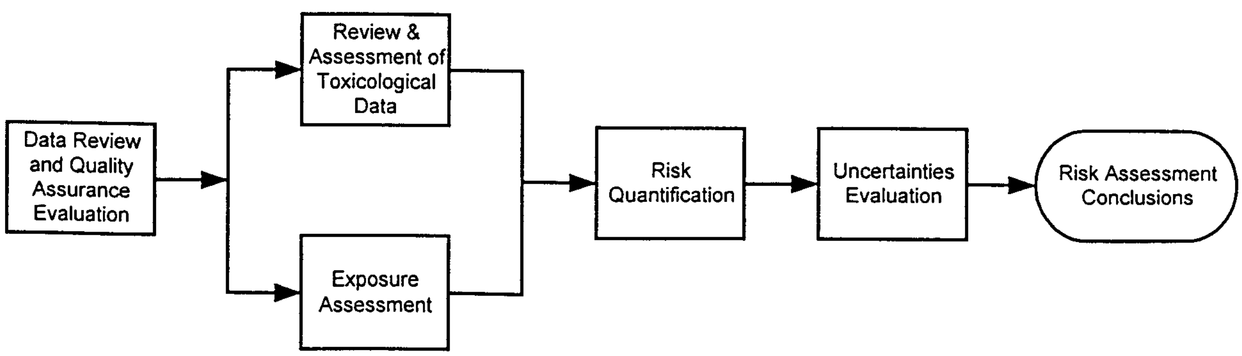

FIGURE 1-4
POST-DEMOLITION RISK ASSESSMENT PROCESS

First, the post-demolition data associated with Parcel A were reviewed and the analytical results compiled. The data were screened according to data usability criteria established for risk assessment. Of the data meeting these quality criteria, constituents of potential concern (COPCs) were selected based on frequency of detection, mobility, and persistence.

Second, those COPCs for which EPA toxicity data exist - as published in the California Cancer Potency Factors Update, Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Tables (HEAST) - were selected for risk analysis. For COPCs without such toxicity data, health-based evaluations could not be completed.

In Step 3, comprehensive post-demolition exposure scenarios were developed that describe the potential exposures at Parcel A and provide a basis for quantifying those exposures. Each exposure scenario was developed to address the source of residual COPCs, route or mechanism of exposure, and potentially exposed populations (known as "receptors"). When site-specific data for scenario development were unavailable, conservative values found in the literature were used.

In Step 4, the toxicity and exposure assessments were summarized and integrated into quantitative expressions of risk. Specially designed spreadsheets were developed to calculate COPC-specific, multipathway risks for each of the Parcel A receptors.

Usually, the risk values presented in a risk assessment are not fully probabilistic estimates of risk but conditional estimates given a considerable number of assumptions about exposure and toxicity. Thus, it is important to fully specify the assumptions and uncertainties inherent in the risk assessment to place the risk estimates in proper perspective. This process is conducted in Step 5.

Step 6 involves the development and presentation of conclusions that can be inferred from the findings of the risk assessment. This step is useful in providing risk managers insight into the interpretation of the risk assessment results.

1.7 GUIDANCE DOCUMENTS

The following major guidance documents and/or information sources were used in the preparation of this risk assessment:

- Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities (Cal/EPA 1992)
- Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual, Part A (EPA 1989a)
- Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual, Part C, Risk Evaluation of Remedial Alternatives (EPA 1991a)
- Guidance for Data Usability in Risk Assessment (EPA 1992c)
- Exposure Factors Handbook (EPA 1990a)
- Dermal Exposure Assessment: Principals and Applications (EPA 1992a)
- California Cancer Potency Factors (Cal/EPA 1996)
- Integrated Risk Information System (IRIS) database (EPA 1997a)
- Health Effects Assessment Summary Tables, Annual FY-1997 (EPA 1997b)
- Superfund Exposure Assessment Manual (EPA 1988c)

1.8 REPORT ORGANIZATION

The COPCs for Parcel A are identified in Section 2. This section discusses data sources used in the post-demolition risk assessment within the context of a hierarchy developed on the basis of the data quality criteria. Section 2 also presents the methodology used to determine the preliminary and final lists of COPCs.

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Section 3 summarizes toxicity information (both carcinogenic and noncarcinogenic effects) for each Parcel A COPC. This section also identifies the toxicity criteria used to characterize potential health risks.

The conceptual exposure model is addressed in Section 4. This section characterizes the physical and chemical setting of the C-6 site, with an emphasis on Parcel A COPC sources, land use, current geological and hydrological conditions, and potentially exposed populations. Through the Parcel A conceptual exposure model, possible exposure pathways are identified, and those pathways deemed significant to the identified receptors are selected for quantitative evaluation.

Exposure point concentrations are calculated in Section 5. The statistical evaluation of soils data and air transport analysis is presented.

Potential health risks to the exposed receptors are characterized in Section 6, Risk Characterization. This section presents the risk characterization methodology and health risk estimates for the Parcel A land use and associated exposure scenarios developed in Section 4.

Uncertainties associated with the predicted risk values are discussed in Section 7. The potential magnitude and direction of bias that may be introduced by each uncertainty factor to the predicted risk values are evaluated. The discussion includes identification of uncertainties related to COPC selection, exposure assessment, toxicity determination, and risk characterization.

Section 8 presents a summary of findings and the conclusions/recommendations of this report as to the health protectiveness of the post-demolition Parcel A and its proposed commercial/industrial land use.

The references used in the development of this report are presented in Section 9.

To assist the reader in understanding how the risk values were derived, risk calculation sheets and additional necessary information are presented in appendices.

Computer printouts from the ISCST3 air dispersion model of the COPCs are presented in Appendix A.

Appendix B is a complete set of COPC intake and risk calculation sheets arranged by receptor. Both carcinogenic and noncarcinogenic risk calculations are presented for each receptor via each significant exposure pathway.

<u>Appendix C contains the complete set of data used in the post-demolition risk assessment. Statistical summaries are also provided.</u>

<u>The equations used in the statistical evaluation of the post-demolition data set are presented in Appendix D.</u>

<u>The Peclet calculation used to identify vapor transport mechanisms at the site is presented in Appendix E.</u>

SECTION 2

CONSTITUENTS OF POTENTIAL CONCERN

2. CONSTITUENTS OF POTENTIAL CONCERN

Throughout the course of the Parcel A investigation and demolition program, numerous soil samples have been collected. However, because these samples were designed to address specific site characterization issues, not all can be used in a health risk assessment. A detailed data evaluation process was required to determine the validity and usefulness of the sample results in this quantitative risk assessment (EPA 1992b).

Section 2.1 summarizes the historical and recent data collection efforts and characterizes the overall post-demolition site conditions at Parcel A. Section 2.2 presents the validation and quality assessment procedures for the analytical data collected.

Once the data were determined to be valid and of sufficient quality to be used in a quantitative risk assessment, further screening procedures were employed to identify the constituents of potential concern (COPCs). The screening process was designed to: 1) reduce the number of analytes to a manageable size, so a detailed quantitative risk analysis could be performed, 2) ensure the analytes selected represent the majority of the site-related risk, and 3) ensure that all localized "hot spots" are addressed. Section 2.3 discusses the screening and selection procedures for Parcel A COPCs. The selected COPCs are used throughout the remainder of the post-demolition risk assessment.

2.1 SUMMARY OF DATA SOURCES

This section addresses the sources and types of data as well as other site-specific information used in the selection of the post-demolition COPCs for Parcel A. The data evaluated include the analytical results of over 10 years of sampling Parcel A surface and subsurface soils.

2.1.1 Historical Soils Data

Woodward-Clyde Consultants conducted the first investigations of the C-6 facility during its underground storage tank (UST) management program (WCC 1987). Later, Woodward-Clyde and James M. Montgomery Consulting Engineers conducted expanded investigations (WCC 1990 and JMM 1992).

A Phase I environmental assessment of Parcel A was conducted by Kennedy/Jenks in 1996 (K/J 1996a). Areas believed to be of "environmental interest" were identified, including those where contamination had already been detected, where chemicals were used or stored, where surface staining was visible, or where sumps, tanks, or clarifiers were located.

The data from these historical studies are further evaluated later in this section.

2.1.2 Parcel A Phase II Soil Data

Prior to demolition, Parcel A was systematically sampled to identify potential areas of contamination. Sampling locations were closely correlated with known facility operations and findings from previous investigation results (K/J 1997). Analytical results from the Parcel A Phase II Soil Characterization were supplied to RWQCB and DTSC for review in July 1997 (K/J 1997). These data represent the most recent characterization of site conditions prior to demolition. <u>Except for the data pertaining to soils excavated during demolition (see Section 2.1.5, below), the Phase II data were used in this post-demolition risk assessment.</u>

2.1.3 Imported-Soils Data

Approximately 20,000 cubic yards of clayey soils were imported from several off-site locations for use as backfill. These soils are referred to throughout this report as *imported soils*. Samples were collected from each place of origin to ensure that material being introduced to the site <u>was not contaminated.</u> Once the material had been shown to be "clean," it was released for use as backfill. The analytical results of this sampling were not considered in the selection of COPCs for this risk assessment or in the statistical derivation of exposure point concentrations, due to the clean nature of the imported soils.

2.1.4 Verification Data

Under a self-imposed program, contaminated soils identified during demolition were excavated until the remaining contaminant concentrations were below the health-based remediation goals (HBRGs) developed by Integrated (IESI 1997b). The chemical properties of these residual areas is characterized in the soil confirmation reports (MW 1997a, 1997b, 1997c, 1997d, 1997e). The results of the soil samples taken from these areas were used in the selection of post-demolition COPCs for this risk assessment.

It is important to note the these HBRG values have not been approved by DTSC as site cleanup goals and were used only for internal, soil-screening purposes during demolition. The use of these values does not guarantee DTSC approval of soil closure and were used at Boeing's own risk. It is understood by all parties that the findings of this risk assessment will establish whether Parcel A requires further remediation.

2.1.5 Excavated-Soils Data

Excavations were conducted to remove affected soils identified during demolition. Specifically, soils were excavated based on any of four criteria: a PID reading greater than 5 ppm, visible staining, a noticeable odor, or as indicated by sampling conducted in accordance with the Sampling and Analysis Plan for Demolition Activities (IESI 1997a). In accordance with RWQCB direction, these soils were stockpiled in 250-cubic-yard lots and characterized. Soils exceeding the HBRG values or Title 22 criteria were shipped off-site for proper disposal. Soils shown to have concentrations below the self-imposed HBRGs and Tittle 22 limits were cleared by RWQCB for use as backfill (MW 1997a, 1997b, 1997c, 1997d, 1997e).

The sample results of soil used as backfill are included in the selection of COPCs and the statistical derivation of exposure point concentrations (MW 1997a, 1997b, 1997c, 1997d, 1997e).

2.2 DETERMINATION OF DATA USEABILITY

The data validation process for the post-demolition risk assessment was divided into several steps. The first step was to compile all site-related analytical data. This was followed by a screening of data that reflect Parcel A conditions, a review of sampling protocols and documentation, the determination of data sources, and an examination of data qualifiers and flags. Overall, the results of more than 1,500 samples were compiled, sorted, and reviewed. Section 2.1 identifies those data that reflect current Parcel A conditions. The rest of the data usability determination is discussed below.

2.2.1 Documentation

The key field documents reviewed in the validation process are:

- Field daily activity logs
- Sample collection logs
- Specific field forms for sample collection and handling
- Chain-of-custody forms and requests for analysis
- Field personnel training documents
- Variances, surveillance reports of field activities

The key analytical data reviewed in the validation process are:

- Organic constituents
  - Holding times

  - Gas chromatography/mass spectroscopy (GC/MS) calibration
  - Surrogate recoveries
  - Matrix spikes, matrix spike duplicates
  - Blank evaluations using the 5X/10X rule
  - Internal standards
- Inorganic constituents
  - Holding times
  - Inductively Coupled Plasma/Graphite Furnace Atomic Analysis (ICP/GFAA)
  - Instrument performance checks
  - Initial and continuing calibrations
  - Blank evaluations
  - Spike sample analyses

2.2.2 Data Sources

Depending on the objectives of the individual studies, the following three types of analytical data have been acquired throughout the investigation and demolition phases of the Parcel A redevelopment project:

1. Field-screening data, collected using field test kits, chemical-specific probes, and other monitoring equipment.
2. Field-laboratory data, from analyses conducted by state-certified field (mobile) laboratories using instruments and procedures equivalent to those of fixed-laboratory analyses.
3. Fixed-laboratory data, from analyses conducted on the majority of all samples submitted for analysis.

No field-screening results were used in this post-demolition risk assessment. Only results obtained using field- or fixed-laboratory analyses were considered.

2.2.3 Data Validation

Data validation is an after-the-fact, independent, and systematic process of evaluating data and comparing the results to pre-established criteria. For this post-demolition risk assessment, specific quality control indicators associated with the data were reviewed to determine whether the stipulated data quality objectives have been met. The objectives addressed five principal parameters: precision, accuracy, completeness, comparability, and representativeness. To verify that the objectives were met, field measurements, sampling and handling procedures, laboratory analysis and reporting, and nonconformance and discrepancies in the data were examined to determine compliance with the appropriate and applicable procedures. The procedures and criteria for validation are defined in the RI/FS Data Validation Program Guidelines, which are based on the EPA National Functional Guidelines for Data Review (EPA 1988a, 1988b).

The validation process culminates in the assignment of a qualifier flag for each analyte defining the confidence level in the data. The measured constituent concentrations obtained during the investigative and demolition phases of Parcel A sampling and used in this risk assessment have been validated. Analytical results for constituents were reported using Contract Laboratory Program (CLP) data qualifiers. Matrix spike and matrix spike duplicate data were analyzed as stipulated in EPA guidance (EPA 1992c).

Data that do not adequately meet the criteria addressed during data validation were flagged with an "R" qualifier and were not used in the quantitative risk assessment. Data flagged with the "J" qualifier, meaning the values are "estimated," were used in the quantitative risk assessment according to EPA guidance (EPA 1988a, 1988b, 1992c).

2.2.4 Detection Limits

The screening of analytical methods used in sample analysis is critical to the inclusion of data for risk assessment purposes (EPA 1992c). Throughout the numerous investigations, there were times when samples were taken from the same location and analyzed for the same constituents using different analytical methods or detection limits. In the data validation process, those samples that have the lowest detection limits were retained for selection of COPCs.

In determining data usability for risk assessment, the analytical methods employed were first reviewed and selected. The selected method is the one that meets risk assessment requirements and has sufficient quality control measures to ensure confident identification and quantitation of target compounds. The detection limit of the method directly affects the usefulness of the data, as constituents reported near the detection limit have a greater possibility of false negatives and positives.

2.2.5 Consistency in Data Collection

Data collection activities may vary among parties conducting the sampling. All parties collecting environmental analytical data for the post-demolition risk assessment were required to follow the Sampling and Analysis Plan (SAP) for Demolition Activities (IESI 1997a) and supporting procedures that direct quality-related activities. The SAP includes the data quality objectives, work performance requirements to meet the objectives, means for verifying the objectives have been met, and a discussion of the data validation process. Before the inclusion of any historical data in this quantitative risk assessment, the data were reviewed thoroughly to ensure the analytical results are of the highest quality.

2.2.6 Qualified Data

All data were validated based upon the criteria presented in Section 2.2.3. When quality control indicators were found to be below the acceptable performance criteria, the accompanying data results were given qualifiers. All data not assigned qualifiers are of acceptable quality and were used during COPC selection. Estimated quantitative results, such as those identified by a "J" qualifier, were used in COPC selection (EPA 1992c). The "J" qualifier describes an estimated value for a tentatively identified constituent or one that is present but whose value is less than the required quantitation limit. Analytical results that are at or below detection limits were qualified with a "U" and were used in the post-demolition risk assessment as described in Section 2.5.1.

"X" qualifiers were assigned to all data found to be invalid as described in Section 5.2. The 1987 Woodward-Clyde subsurface investigation results were found to be below acceptance criteria for use in the post-demolition risk assessment. Numerous samples collected since this study in the same sample locations have shown dramatically different results. These Woodward-Clyde results have not been included in this post-demolition risk assessment.

2.2.7 Data Usability Summary

The approach for selecting suitable data for the risk assessment follows EPA guidance (EPA 1992c). All data were evaluated according to the aforementioned criteria of precision, accuracy completeness, comparability, and representativeness. With the exception of the 1987 Woodward-Clyde subsurface investigation report (WCC 1990), Parcel A characterization data were found to be valid and of acceptable usability for inclusion in this quantitative risk assessment. Appendix C presents the data set used in the post-demolition risk assessment.

2.3 SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN

Due to the extensive amount of historical data for soils and the number of non-detected analytes reported under the standard SW846 methods, a screening methodology was developed to identify COPCs. The objectives of this screening process were to: 1) reduce the number of analytes to a manageable size, so a detailed quantitative risk analysis could be performed on detected constituents, 2) ensure the analytes selected represent the Parcel A related post-demolition risk, and 3) ensure that all localized hot spots have been addressed. The following presents the COPC identification process as agreed upon by DTSC/HERD and Integrated (IESI 1998a).

The screening methodology for detected constituents in Parcel A soils was developed in a conservative manner to ensure that all COPCs and localized hot spots are addressed. The following methodology has been agreed upon between DTSC/HERD and Integrated:

1. Identify all constituents detected in Parcel A soils.

2. Retain all Group A carcinogens.

3. Calculate the frequency of detection per constituent, per medium.

4. Retain all constituents detected at a frequency of 5 percent or higher (per medium).

5. Retain all organic constituents detected at a frequency of less than 5 percent (per medium) with maximum detects that exceed EPA Region IX residential preliminary remediation goals (PRGs) or DTSC/HERD surrogate values.

6. Compare the 95 percent upper confidence limit (UCL) concentrations of inorganic constituents (normal distribution) to environmental background concentrations. Retain all inorganic constituents that exceed the background levels.

Step 1

Table 2-1 lists constituents detected in at least one soil sampling event on Parcel A. A constituent was not included in the initial COPC list if the analysis performed on it is designed for compound-class identification or if its analytical results are not compound specific.

Step 2

There are obvious health concerns whenever the potential for exposure to known human carcinogens exists. Therefore, the identification and analysis of these substances is of the utmost importance in a quantitative risk assessment. In assessing carcinogenic potential, EPA classifies constituents into five groups based on the weight of evidence collected from epidemiological studies. These studies examine the relationship between exposure to a constituent and the subsequent development of cancer. The five groups are:

- Group A — Human carcinogen (sufficient evidence of carcinogenicity in humans)
- Group B — Probable human carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence in animals with inadequate or lack of evidence in humans)
- Group C — Possible human carcinogen (limited evidence of carcinogenicity in animals and inadequate evidence in humans)
- Group D — Not classifiable as to human carcinogenicity (inadequate or no evidence)
- Group E — Evidence of noncarcinogenicity for humans (no evidence of carcinogenicity in adequate studies)

No organic Group A constituents were detected in Parcel A. The only inorganic Group A constituent detected, arsenic, was retained as a COPC.

Steps 3 and 4

Frequency of detection was calculated for each constituent to identify those found throughout Parcel A soils. Constituents found in more than 5 percent of soil samples are most likely, based of abundance and distribution, to present receptor exposures. Therefore, these "frequently detected" constituents were retained for quantitative risk analysis.

Step 5

The maximum concentrations of organic constituents detected in less than 5 percent of soil samples were compared to EPA Region IX preliminary remediation goals (PRGs) or DTSC/HERD surrogate values for residential exposures. Those exceeding residential PRGs were retained as COPCs. Those that do not exceed residential PRGs are not anticipated to pose a significant risk based on limited distribution and exposure potential.

TABLE 2-1
SOIL COPC IDENTIFICATION SUMMARY

Constituent	CAS No.	EPA Group	Residential PRG (mg/kg)	Background Concentration (mg/kg)	95% UCL Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection (%)	Rationale
COPCs								
1,1-dichloroethylene	75-35-4	C	3.70E-02	NA	5.53E-03	7.60E-01	11.48	Freq.>5% [b]
1,2,4-trimethyl benzene	95-63-6	NA	1.20E+03*	NA	9.17E-03	2.40E+01	8.96	Freq.>5% [b]
1,3,5-trimethyl-benzene	108-67-8	NA	1.43E+03*	NA	6.31E-03	7.80E+00	6.84	Freq.>5% [b]
aroclor 1248	12672-29-6	NA	6.60E-02	NA	1.86E-02	9.80E+00	1.26	>PRG[c]
aroclor 1254	11097-69-1	NA	6.60E-02	NA	1.80E-02	5.10E-01	0.95	>PRG[c]
aroclor 1260	11096-82-5	NA	6.60E-02	NA	1.76E-02	1.70E-01	1.58	>PRG[c]
arsenic	7440-38-2	A	—	1.40E+01	1.50E+00	4.90E+01	4.57	EPA Group A[a]
benzo(a)anthracene	56-55-3	B2	6.10E-01	NA	1.26E-01	6.20E+00	9.01	Freq.>5% [b]
benzo(a)pyrene	50-32-8	B2	6.10E-02	NA	2.38E-01	3.30E+00	5.01	>PRG[c]
benzo(b)fluoranthene	205-99-2	B2	6.10E-01	NA	2.47E-01	3.30E+00	5.58	Freq.>5% [b]
benzo(k)fluoranthene	207-08-9	B2	6.10E-01	NA	2.18E-01	1.30E+00	3.58	>PRG[c]
bis(2-ethylhexyl)phthalate	117-81-7	B2	3.20E+01	NA	1.20E-01	2.10E+02	6.29	Freq.>5% [b]
chrysene	218-01-9	B2	6.10E+00	NA	1.43E-01	8.80E+00	11.44	Freq.>5% [b]
dibenzo(a,h)anthracene	53-70-3	B2	6.10E-02	NA	9.51E-02	6.20E-01	0.72	>PRG[c]
fluoranthene	206-44-0	D	2.60E+03	NA	1.36E-01	1.00E+01	10.87	Freq.>5% [b]
indeno(1,2,3-cd)pyrene	193-39-5	B2	6.10E-01	NA	2.26E-01	1.50E+00	3.43	>PRG[c]
naphthalene	91-20-3	D	2.40E+02	NA	2.14E-01	6.30E+01	5.25	Freq.>5% [b]
n-butylbenzene	104-51-8	NA	1.64E+02*	NA	4.97E-03	6.80E-01	5.42	Freq.>5% [b]
n-propylbenzene	103-65-1	NA	1.64E+02*	NA	4.64E-03	1.30E+00	5.42	Freq.>5% [b]
p-cymene	99-87-6	NA	7.85E+02*	NA	4.37E-03	5.10E-01	5.19	Freq.>5% [b]
phenanthrene	85-01-8	D	1.40E+02*	NA	1.53E-01	3.60E+01	8.87	Freq.>5% [b]
pyrene	129-00-0	D	1.00E+02	NA	1.53E-01	2.60E+01	11.44	Freq.>5% [b]
tetrachloroethylene	127-18-4	NA	5.40E+00	NA	3.72E-03	9.90E+01	2.72	>PRG[c]
trichloroethylene	79-01-6	NA	3.20E+00	NA	7.68E-03	9.90E-01	16.76	Freq.>5% [b]
xylenes, total	1330-20-7	D	3.20E+02	NA	4.56E-03	3.70E+00	5.19	Freq.>5% [b]

TABLE 2-1
SOIL COPC IDENTIFICATION SUMMARY
(CONTINUED)

Constituent	CAS No.	EPA Group	Residential PRG (mg/kg)	Background Concentration (mg/kg)	95% UCL Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection (%)	Rationale
Do Not Exceed Background								
barium	7440-39-3	NA	—	2.81E+02	1.12E+02	3.60E+02	98.31	<Background[d]
beryllium	7440-41-7	B2	—	7.40E-01	5.20E-01	1.00E+02	7.75	<Background[d]
cadmium	7440-43-9	B1	—	8.80E-01	2.54E-01	1.60E+01	10.53	<Background[d]
chromium, total	7440-47-3	NA	—	4.10E+01	2.73E+01	2.70E+02	98.51	<Background[d]
cobalt	7440-48-4	NA	—	2.00E+01	8.74E+00	4.81E+01	98.51	<Background[d]
copper	7440-50-8	D	—	5.30E+01	1.67E+01	1.71E+02	98.31	<Background[d]
lead	7429-92-1	B2	—	1.10E+02	3.63E+00	3.50E+02	22.14	<Background[d]
mercury	7439-97-6	D	—	2.80E-01	2.02E-02	1.26E+00	3.87	<Background[d]
molybdenum	7439-98-7	NA	—	2.30E+01	5.39E-01	6.97E+00	0.79	<Background[d]
nickel	7440-02-0	NA	—	2.90E+01	1.24E+01	1.40E+02	97.42	<Background[d]
thallium	7440-28-0	D	—	1.10E+01	1.08E+01	1.10E+01	0.30	<Background[d]
vanadium	7440-62-2	NA	—	8.20E+01	3.18E+01	7.55E+01	98.41	<Background[d]
zinc	7440-66-6	D	—	1.98E+02	5.36E+01	4.70E+02	98.41	<Background[d]
Less Than 5% and Max. Less Than Residential PRG								
1,1,1-trichloroethane	71-55-6	NA	1.20E+03	NA	5.30E-02	1.30E+01	1.29	<5%+<PRG[e]
1,1,2-trichloroethane	79-00-5	NA	6.50E-01	NA	3.58E-03	2.10E-01	1.00	<5%+<PRG[e]
1,1-dichloroethane	75-34-3	C	5.00E+02	NA	9.51E-03	1.30E+00	2.87	<5%+<PRG[e]
2-methylnaphthalene	91-57-6	NA	8.00E+02*	NA	8.42E-01	1.30E+02	4.01	<5%+<PRG[e]
acenaphthene	83-32-9	NA	1.10E+02	NA	9.70E-02	1.90E+00	1.43	<5%+<PRG[e]
anthracene	120-12-7	D	5.70E+00	NA	1.26E-01	5.00E+00	3.29	<5%+<PRG[e]
benzene, 1-methylethyl-	98-82-8	NA	1.90E+01	NA	8.97E-03	3.20E-01	3.30	<5%+<PRG[e]
benzo(ghi)perylene	191-24-2	NA	4.20E+00*	NA	1.88E-01	1.80E+00	4.15	<5%+<PRG[e]
cis-1,2-dichloroethylene	156-59-2	D	3.10E+01	NA	3.49E-03	8.30E-02	1.72	<5%+<PRG[e]

TABLE 2-1
SOIL COPC IDENTIFICATION SUMMARY
(CONTINUED)

Constituent	CAS No.	EPA Group	Residential PRG (mg/kg)	Background Concentration (mg/kg)	95% UCL Concentration (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection (%)	Rationale
Less Than 5% and Max. Less Than Residential PRG (Cont.)								
ethylbenzene	100-41-4	D	2.30E+02	NA	1.27E-02	1.70E+00	2.01	<5%+<PRG[e]
fluorene	86-73-7	D	9.00E+01	NA	1.37E-01	6.40E+00	2.43	<5%+<PRG[e]
methylene chloride	75-09-2	B2	7.80E+00	NA	5.03E-03	3.50E-02	0.72	<5%+<PRG[e]
p-chloro-m-cresol	59-50-7	NA	3.26E+03*	NA	1.58E-01	1.90E+01	0.29	<5%+<PRG[e]
sec-butylbenzene	135-98-8	NA	1.64E+02*	NA	1.20E-02	3.80E-01	4.72	<5%+<PRG[e]
tert-butylbenzene	98-06-6	NA	1.64E+02*	NA	2.46E-02	2.70E+00	2.59	<5%+<PRG[e]
toluene	108-88-3	D	7.90E+02	NA	5.58E-02	1.40E+01	0.72	<5%+<PRG[e]
trans-1,2-dichloroethene	156-60-5	NA	7.80E+01	NA	3.14E-03	5.70E-02	0.14	<5%+<PRG[e]
trichlorofluoromethane	75-69-4	NA	3.80E+02	NA	5.01E-03	3.30E-02	0.43	<5%+<PRG[e]

RATIONALE:
[a]Selected as a COPC based on status as a "known carcinogen" (EPA Group A)
[b]Selected as a COPC because frequency of detection is above 5%.
[c]Selected as a COPC because maximum concentration exceeds EPA Region IX residential PRG.
[d]Eliminated as a COPC because 95% UCL concentration does not exceed background level.
[e]Eliminated as a COPC because frequency is below 5% and maximum concentration is below EPA Region IX residential PRG.

SOURCES:
EHP 1997 (EPA Weight-of-Evidence Group)
G&M 1997 (Background Concentration) per DTSC/HERD agreement (IESI 1998b)
EPA 1997 (Residential PRGs)
*Cal/EPA 1998 (DTSC surrogate PRG values)

ABBREVIATIONS:
NA = Not Applicable
UCL = Upper Confidence Limit

Step 6

Finally, inorganic constituent concentrations were compared to background concentrations. This was required to distinguish Parcel A related constituents from naturally occurring or unrelated anthropogenic constituents. The presence of unrelated anthropogenic constituents in the environment is due to human activity not attributed to Parcel A, such as deposition from automobile emissions. If the 95 percent UCL concentration of a detected inorganic constituent (normal distribution) is less than its background level, then that constituent was excluded from the COPC list. By agreement with DTSC/HERD (IESI 1998a), the recent risk assessment for the adjacent Lockheed Martin ILM property (G&M 1996) was used as the source of inorganic background levels.

Table 2-1, above, summarizes the COPC identification process for the Parcel A soils. Table 2-2, below, lists the resultant COPCs.

TABLE 2-2
COPCs FOR PARCEL A

1,1-dichloroethene	benzo(b)fluoranthene	n-butylbenzene
1,2,4-trimethylbenzene	benzo(k)fluoranthene	n-propylbenzene
1,3,5-trimethylbenzene	bis(2-ethylhexyl)phthalate	p-cymene
aroclor 1248	chrysene	phenanthrene
aroclor 1254	dibenzo(a,h)anthracene	pyrene
aroclor 1260	fluoranthene	tetrachloroethylene
arsenic	indeno(1,2,3-cd)pyrene	trichloroethene
benzo(a)anthracene	naphthalene	xylenes
benzo(a)pyrene		

SECTION 3

TOXICITY ASSESSMENT

3.4 POTENCY EQUIVALENCE FACTORS

One approach used to assess the cancer risk of mixtures of structurally related compounds such as PAHs is to characterize the toxicities of these compounds relative to the toxicity of a compound representative of the group. This is known as the potency equivalence factors (PEFs) approach and it takes into account the differing potencies of carcinogenic compounds from structurally related mixtures. This weighting scheme for PAHs was developed by the Air Toxicology and Epidemiology Section of the Office of Environmental Health Hazard Assessment in the document entitled *Health Effects of Benzo(a)pyrene* (Cal/EPA 1993).

The PEF values presented in Table 3-3 may be used for both inhalation and oral exposure pathways, although data used for their development were prioritized so inhalation exposure received higher priority than did other exposures. The benzo(a)pyrene CSF was multiplied by the appropriate chemical-specific PEF value to derive oral and inhalation toxicity values. The COPCs for which this process was conducted are noted in Table 3-2.

TABLE 3-3
POTENCY EQUIVALENCE FACTORS (PEFs) FOR POLYAROMATIC HYDROCARBONS (PAHs)

PAH or Derivative	CAS No.	Suggested PEF
benzo(a)pyrene (index compound)*	50-32-8	1.0
1,6-dinitropyrene	42397-64-8	10
1,8-dinitropyrene	42397-65-9	1.0
1-nitropyrene	5522-43-0	0.1
2-nitrofluorene	607-57-8	0.01
4-nitropyrene	57835-92-4	0.1
5-methylchrysene	3697-24-3	1.0
6-nitrocrysene	7496-02-8	10
7H-dibenzo(c,g)carbazole	194-59-2	1.0
benzo(a)anthracene*	56-55-3	0.1
benzo(b)fluoranthene*	205-99-2	0.1

TABLE 3-3
POTENCY EQUIVALENCE FACTORS (PEFs) FOR POLYAROMATIC HYDROCARBONS (PAHs)
(CONTINUED)

PAH or Derivative	CAS No.	Suggested PEF
benzo(j)fluoranthene	205-82-3	0.1
benzo(k)fluoranthene*	207-08-9	0.1
chrysene*	218-01-9	0.01
dibenz(a,h)acridine	226-36-8	0.1
dibenz(a,j)acridine	224-42-0	0.1
dibenzo(a,e)pyrene	192-65-4	1.0
dibenzo(a,h)pyrene	189-64-0	10
dibenzo(a,i)pyrene	189-55-9	10
dibenzo(a,l)pyrene	191-30-0	10
indeno(1,2,3-c,d)pyrene*	193-39-5	0.1

*Parcel A COPC

SOURCE:
Health Effects of Benzo(a)pyrene (Cal/EPA 1993)

3. TOXICITY ASSESSMENT

The objective of this section is to provide information on the toxic effects of exposure to constituents. More specifically, the section provides a quantitative estimate of the relationship between exposure and severity or probability of human biological effects for each constituent of potential concern (COPC) identified in Section 2.

Section 3.1 describes how toxicity values are established and used for noncarcinogenic COPCs, while Section 3.2 presents a similar discussion of carcinogenic COPCs. Section 3.3 describes how dermal exposures are quantified.

Relevant carcinogenic and noncarcinogenic toxicity data were obtained from the following sources (in descending order of preference):

1. California Cancer Potency Factors Update (Cal/EPA 1996)
2. Integrated Risk Information System (IRIS) on-line database (EPA 1997a)
3. Health Effects Assessment Summary Tables (HEAST) for FY 1997 (EPA 1997b)
4. Cal/EPA Potency Equivalency Factors for Poly-Aromatic Hydrocarbons (Cal/EPA 1993)
5. Surrogate values provided by DTSC/HERD (Cal/EPA 1998)

Searches of the IRIS database were made in January 1998.

3.1 NONCARCINOGENIC CONSTITUENTS

For the noncarcinogenic effects of constituents, EPA assumes a dose exists below which no adverse health effects will be seen (EPA 1989a). Below this "threshold," it is believed exposure to a constituent can be tolerated without adverse effects, and the body burden is not increased.

Toxic effects become manifest only when physiologic protective mechanisms are overcome by exposure doses above the threshold.

The reference dose (RfD), expressed in units of milligrams per kilogram-day (mg/kg-d), represents the daily intake (averaged over a year) of a constituent per kilogram of body weight which is below the effect threshold for that constituent. In essence, the RfD represents the receptor-specific threshold dose. In addition, EPA assumes noncarcinogenic exposure doses are not cumulative from age group to age group over a lifetime of exposure (EPA 1989a). An RfD is specific to the constituent, route of exposure, and duration over which the exposure occurs.

The EPA reviews all relevant human and animal studies for each constituent and selects the studies pertinent to the derivation of specific RfDs. Each study is evaluated to determine the no-observable-adverse-effect level (NOAEL) or, if data are inadequate for such a determination, the lowest-observable-adverse-effect level (LOAEL). The NOAEL corresponds to the dose (mg/kg-d) that can be administered over a lifetime without inducing observable adverse effects. The LOAEL corresponds to the lowest daily dose (mg/kg-d) that can be administered over a lifetime that induces an observable adverse effect. The toxic effect characterized by the LOAEL is referred to as the "critical effect" (EPA 1997a).

To derive an RfD, the NOAEL (or LOAEL) is divided by uncertainty factors to ensure that the RfD will be protective of human health. Uncertainty factors are applied to account for: 1) extrapolation of data from laboratory animals to humans (interspecies extrapolation), 2) variation in human sensitivity to the toxic effects of a constituent (intraspecies differences), 3) derivation of a chronic RfD based on a subchronic rather than a chronic study, and 4) derivation of an RfD from the LOAEL rather than the NOAEL. Each of these uncertainties usually represents a factor of 10. In addition to these uncertainty factors, modifying factors between 0 and 10 may be applied to reflect additional qualitative considerations in evaluating the data (EPA 1989a).

The inhalation and oral RfDs for the noncarcinogenic COPCs at Parcel A are presented in Table 3-1. The primary source for toxicological reference values is the IRIS on-line database (EPA

1997a), which contains current health risk and regulatory information. Provisional RfDs are tabulated in HEAST (EPA 1997b). When values were not available from the above-mentioned sources, surrogate values were provided by DTSC/HERD, as noted in Table 3-1 (Cal/EPA 1998).

TABLE 3-1
COPC-SPECIFIC REFERENCE DOSE VALUES*

COPC	Subchronic Inhalation RfD (mg/kg-d)	Chronic Inhalation RfD (mg/kg-d)	Subchronic Oral RfD (mg/kg-d)	Chronic Oral RfD (mg/kg-d)
1,1-dichloroethene	9.00E-03	9.00E-03	9.00E-03	9.00E-03
1,2,4-trimethylbenzene	2.00E-03	2.00E-03	5.00E-01	5.00E-01
1,3,5-trimethylbenzene	2.00E-03	2.00E-03	5.00E-01	5.00E-01
aroclor 1248	7.00E-05	7.00E-05	7.00E-05	7.00E-05
aroclor 1254	7.00E-05	7.00E-05	7.00E-05	7.00E-05
aroclor 1260	7.00E-05	7.00E-05	7.00E-05	7.00E-05
arsenic	3.00E-04	3.00E-04	3.00E-04	3.00E-04
benzo(a)anthracene	4.00E-02	4.00E-02	4.00E-02	4.00E-02
benzo(a)pyrene	4.00E-02	4.00E-02	4.00E-02	4.00E-02
benzo(b)fluoranthene	4.00E-02	4.00E-02	4.00E-02	4.00E-02
benzo(k)fluoranthene	4.00E-02	4.00E-02	4.00E-02	4.00E-02
bis(2-ethylhexyl)phthalate	2.00E-02	2.00E-02	2.00E-02	2.00E-02
chrysene	4.00E-02	4.00E-02	4.00E-02	4.00E-02
dibenzo(a,h)anthracene	4.00E-02	4.00E-02	4.00E-02	4.00E-02
fluoranthene	4.00E-01[b]	4.00E-02[a]	4.00E-01[b]	4.00E-02[a]
indeno(1,2,3-cd)pyrene	4.00E-02	4.00E-02	4.00E-02	4.00E-02
naphthalene	4.00E-02[b]	4.00E-02[a]	4.00E-02[b]	4.00E-02[a]
n-butylbenzene	2.90E-01	2.90E-01	1.00E-01	1.00E-01
n-propylbenzene	2.90E-01	2.90E-01	1.00E-01	1.00E-01
p-cymene	1.00E-01	1.00E-01	1.00E-01	1.00E-01
phenanthrene	3.00E-01	3.00E-01	3.00E-01	3.00E-01
pyrene	3.00E-01[b]	3.00E-02[b]	3.00E-01[b]	3.00E-02[a]
tetrachloroethylene	1.00E-01[b]	1.00E-02[b]	1.00E-01[b]	1.00E-02[a]
trichloroethene	7.35E-03	7.35E-03	7.35E-03	7.35E-03
xylenes	2.00E-01	2.00E-01	2.00E+00[b]	2.00E+00[a]

SOURCES:
*DTSC/HERD Surrogate RfD Values (Cal/EPA 1998) except as noted.
[a]IRIS (EPA 1997a)
[b]HEAST (EPA 1997b)

The noncarcinogenic risk associated with a constituent exposure is expressed as the *hazard quotient* (HQ). The HQ is a ratio of the estimated constituent intake, based on the measured or calculated exposure concentration for a constituent (dose), divided by the appropriate oral or inhalation RfD. If the HQ exceeds 1, some harmful effect may occur or the threshold dose may be exceeded. If the HQ is equal to or less than 1, the exposure level is not likely to cause adverse effects. If exposure to multiple constituents occurs, the potential for harmful effects is assessed by summing the HQs and is designated the *hazard index* (HI).

In keeping with EPA guidance (EPA 1989a), all noncarcinogenic risk was considered additive for individual receptors. Since the noncarcinogenic COPCs under investigation at the site are associated with various adverse effects on distinct target organs and systems, the assumption of additivity of effects may overstate the potential for harmful effects. On the other hand, the potential synergistic effects of two or more COPCs must also be recognized. That is, the combined effects of exposure to two COPCs may be worse than exposure to either COPC alone because of interactions.

3.2 Carcinogenic Constituents

The incremental lifetime cancer risk (ILCR) from a carcinogen is calculated as a product of the reasonable maximum daily intake (mg/kg-d) and the cancer slope factor (CSF). EPA's model of carcinogenesis assumes the relationship between exposure to a carcinogen and cancer risk is linear over the entire dose range, except at very high doses (EPA 1989a). This linearity assumes that there is no threshold-of-exposure dose below which harmful effects will not occur. Because of this, carcinogenic effects are considered to be cumulative across age groups when considering lifetime exposures.

CSFs are upper-bound (95 percent upper confidence limit [UCL]) estimates of the increased cancer risk per unit dose, in which risk is expressed as the probability that an individual will develop cancer within his or her lifetime as the result of exposure to a given level of a carcinogen. All cancers or tumors are considered whether or not death occurs as a result. This approach is inherently conservative because of the no-threshold assumption and the use of the 95 percent UCL of the estimated slope of dose versus cancer risk.

In addition to the CSF, the toxicity information considered in the assessment of potential carcinogenic risks includes a weight-of-evidence classification. As discussed in Section 2.3, EPA groups constituents according to their potential for carcinogenic effects based on clinical evidence (EPA 1989a):

- Group A Human carcinogen
- Group B Probable human carcinogen
- Group C Possible human carcinogen
- Group D Insufficient data to classify as a human carcinogen
- Group E Not a human carcinogen

The CSFs for the COPCs studied in this report are presented in Table 3-2. The primary source for toxicological reference values is the California Cancer Potency Factors Update (Cal/EPA 1996), followed by IRIS (EPA 1997a). Provisional CSFs are tabulated in HEAST (EPA 1997b). Surrogate values were provided by DTSC/HERD when not available through the previously mentioned sources (Cal/EPA 1998). These values have been noted in Table 3-2. By agreement between DTSC/HERD and Integrated, 1,1-dichloroethene will not be assessed for carcinogenic risk. This agreement is based on DTSC/HERD's review of the 1,1-dichloroethene CSF and supporting toxicological data (Cal/EPA 1998, IESI 1998b).

3.3 QUANTIFICATION OF DERMAL EXPOSURE RISKS

Dermal RfDs and CSFs are traditionally derived from the corresponding oral values (EPA 1989a). However, DTSC recommends that dermal RfDs and CSFs should not be derived; instead, oral RfDs and CSFs should be used to estimate dermal toxicity values (Cal/EPA 1998b, 1998c).

TABLE 3-2
COPC-SPECIFIC CANCER SLOPE FACTORS (CSFs)*

COPC	Oral CSF 1/(mg/kg-d)	Inhalation CSF 1/(mg/kg-d)
1,1-dichloroethene[a]	NA	NA
1,2,4-trimethylbenzene[a]	NA	NA
1,3,5-trimethylbenzene[a]	NA	NA
aroclor 1248	7.70E+00	7.70E+00
aroclor 1254	7.70E+00	7.70E+00
aroclor 1260	7.70E+00	7.70E+00
arsenic	1.50E+00	1.20E+01
benzo(a)anthracene[b]	1.15E+00	3.90E-01
benzo(a)pyrene	1.15E+01	3.90E+00
benzo(b)fluoranthene[b]	1.15E+00	3.90E-01
benzo(k)fluoranthene[b]	1.15E+00	3.90E-01
bis(2-ethylhexyl)phthalate	8.40E-03	8.40E-03
chrysene[b]	1.15E-01	3.90E-02
dibenzo(a,h)anthracene	4.10E+00	4.10E+00
fluoranthene	NA	NA
indeno(1,2,3-cd)pyrene[b]	1.15E+00	3.90E-01
naphthalene	NA	NA
n-butylbenzene[a]	NA	NA
n-propylbenzene[a]	NA	NA
p-cymene[a]	NA	NA
phenanthrene[a]	NA	NA
pyrene	NA	NA
tetrachloroethylene	5.10E-02	2.10E-02
trichloroethene	1.50E-02	1.00E-02
xylenes	NA	NA

NA = Not Applicable

SOURCES:
*California Cancer Potency Factors Update (Cal/EPA 1996) except as noted.
[a]DTSC/HERD surrogate CSF values (Cal/EPA 1998)
[b]Based on PEF adjustment (see Section 3.4, below).

SECTION 4

CONCEPTUAL EXPOSURE MODEL

4. CONCEPTUAL EXPOSURE MODEL

The conceptual exposure model (CEM) provides the basis for a comprehensive evaluation of the risks to human health by identifying the mechanisms through which receptors may be exposed to residual constituents of potential concern (COPCs). The CEM traces the Parcel A COPCs in a logical flow from their sources through release mechanisms and exposure routes to the potentially affected receptors.

Of particular importance, the CEM identifies which exposure routes are complete and significant under the given land use. These significant pathways are used in the quantitative risk assessment for each receptor. The CEM also facilitates the analysis and screening of exposure pathways likely to pose only minor risks.

Section 4.1 presents the physical characteristics of Parcel A and describes the projected exposures associated with the construction and daily use of the parcel as a commercial/industrial facility. Section 4.2 discusses the possible routes by which Parcel A COPCs could be released to the environment and identifies the pathways significant to the quantification of potential receptor risk. A conceptual model for risk analysis is described that identifies the COPC sources, release mechanisms, potential receptor populations, and significant exposure pathways for the Parcel A land use and associated exposure scenarios

4.1 EXPOSURE SETTING

The specific characteristics of the Parcel A exposure setting influence the availability of COPCs to potential receptors, release mechanisms, exposure routes, and receptor activities. A receptor's actual exposure depends on the site's physical attributes and land use. While discussions of future land use are necessarily speculative, health-protective assumptions have been employed to ensure that a reasonable maximum release of COPCs and, consequently, a reasonable maximum exposure concentration have been postulated.

4.1.1 Site Physical Characteristics

The physical characteristics of Parcel A are described in detail in several site investigation reports prepared for the entire C-6 property (e.g., WCC 1990 and K/J 1997). The following summarizes the published information as it relates to this risk assessment, with an emphasis on the post-demolition COPC sources, release mechanisms, exposure media, and exposure pathways for Parcel A. Highlights of area climate, meteorology, geological setting, soil types, hydrology, and local demographics are presented below.

4.1.1.1 Climate and Meteorology

The C-6 site is located in Los Angeles, California. Average annual temperature is 60 degrees Fahrenheit, ranging from 44 degrees in January to 111 degrees in September. Prevailing winds are from the west and west northwest. Wind speeds range from 4 to 10 knots (K/J 1996c).

4.1.1.2 Regional Geology and Hydrogeology

The site lies within the West Coast Basin, a major groundwater basin which underlies approximately 160 square miles of the coastal plain in southwestern Los Angeles County. Surface geology is characterized by Holocene Age sediments within the Torrance plain. The Torrance plain is defined as the area between Palos Verdes Hills to the south and the distinct belt of hills caused by folding and flexures along the Newport-Inglewood uplift to the north. The Pacific Ocean forms the western boundary of the basin, while the San Pedro Bay and Dominguez Gap form the eastern boundary. The site is underlain by Holocene and Pleistocene alluvium deposits that comprise the local hydrogeologic system described below (MW 1994).

Two geologic formations underlie the property: the Lakewood and the San Pedro. The Lakewood extends to a depth of approximately 180 feet bgs and contains two major hydrogeologic and stratigraphic units known as the Bellflower aquiclude and the Gage aquifer (MW 1994). In the vicinity of the property, the Bellflower aquiclude is composed of low-permeability, late Pleistocene age sediments which lie above the Gage aquifer. Composed predominantly of silty clays, the Bellflower aquiclude extends to approximately 100 feet bgs (MW 1994, K/J 1996d).

The Gage aquifer underlies the Bellflower aquiclude and extends over the entire West Coast basin. In the vicinity of the C-6 site, the Gage is composed of water-bearing, fine-medium to coarse sand with variable amounts of coarse gravels and thin beds of silt and clay. The Gage aquifer is thought to have an approximate thickness of 30 to 40 feet and is encountered at approximately 150 feet bgs (MW 1994).

The San Pedro formation, which underlies the Lakewood formation, consists of lower Pleistocene deposits of marine origin and contains the Lynwood and Silverado aquifers. The San Pedro formation extends to a depth of approximately 1,000 feet bgs (K/J 1996d). The Lynwood aquifer has an approximate thickness of 90 feet and is encountered at a depth of about 310 feet beneath the site. The Silverado aquifer is encountered at a depth of approximately 520 feet bgs. The Silverado is considered a source of drinking water (K/J 1996d) and is the primary water source for the basin due to its high specific yield through the coarser sediments and its good water quality. The Silverado is continuous and merges with the Lynwood aquifer at the base of the El Segundo Sand Hills to the west (MW 1994).

Data collected from monitoring wells installed on the C-6 property indicate that groundwater flow in the region is generally to the southeast. Groundwater beneath the property occurs at approximately 65 feet bgs at the western boundary, flowing generally to the southeast and bending to the south (K/J 1996a, 1996b, 1996c).

4.1.2 Post-Demolition Land Use and Associated Exposure Scenarios

As mentioned, for the purpose of defining potential receptor exposures, this report assumes a single, post-demolition land use for Parcel A as a commercial/industrial facility. Given this land use, two post-demolition exposure scenarios are examined, one associated with construction of the facility (the *construction scenario*), the other associated with its operation (the *commercial/industrial scenario*).

The commercial/industrial land use is consistent with the zoning and deed restrictions to be implemented at Parcel A. While final decisions concerning the exact commercial/industrial uses of the parcel have not been made, reasonable and conservative assumptions concerning potential commercial/industrial uses and facility construction were employed in the development of the exposure scenarios. In this way, the estimated risk values effectively provide a range of anticipated exposures. In developing the exposure scenarios, it was assumed that:

- All construction activities will be completed within 1 year.
- During construction, access controls and security will minimize trespassing.
- After development, the parcel will not have access controls.
- After development, all surfaces will be capped with cement or asphalt (for building foundation, roadways, or parking areas) or covered with vegetation (landscaping).
- All soil containing residual concentrations of COPCs will be covered with at least 2 feet of imported clean soil.

These assumptions are consistent with the scheduled development project and the need to raise the site for proper drainage.

4.1.3 Reasonable Maximum Exposure

EPA (1989a) recommends the use of reasonable maximum exposure (RME) to express the highest exposure that could reasonably occur at a site. As a conservative estimate, the RME is within the range of possible exposures but higher than the typical or average exposure. RMEs are estimated for individual pathways. If a population is exposed to more than one pathway, the sum of the exposures across pathways also represents the RME (EPA 1989a).

Populations potentially affected by site COPCs include people of various ages and lifestyles who live or conduct business at or near the site. Instead of estimating health impacts to a specific individual, this report evaluates potential health effects to representative receptor groups. Each receptor in this risk assessment has been developed to conservatively represent the upper-bound exposures to a group of people that have similar lifestyles or perform similar daily activities. If the risk to the selected receptor is determined to be acceptable, then it is likely that all other receptors within the group with lesser exposures will also be acceptable.

4.2 Conceptual Exposure Model for Parcel A

Figure 4-1 presents the CEM developed to describe the Parcel A exposure setting after demolition, under the construction and commercial/industrial exposure scenarios. Given these scenarios, there are several potential exposure pathways through which a receptor may come in contact with COPCs at Parcel A. Four elements must be present for an exposure pathway to be deemed complete: 1) COPC source, 2) exposure pathway, 3) receptor, and 4) release mechanism. The following sections provide details on these subjects.

4.2.1 COPC Sources

Discussion of COPC sources provides a starting point for the development of the exposure pathways. As described in Section 2.1, the COPC sources considered in this report include:

- Residual concentrations in backfilled and undisturbed areas within the top 12 feet of soil
- Soil COPCs left unexcavated from 12 feet bgs to the top of the Bellflower aquiclude
- Existing COPCs in the Bellflower aquiclude

The CEM (Figure 4-1) addresses all COPCs found at or originating from Parcel A. Under the given land use, the environmental media may act as reservoirs for COPCs that slowly migrate to other environmental compartments or may serve as a direct or indirect source of human exposure.

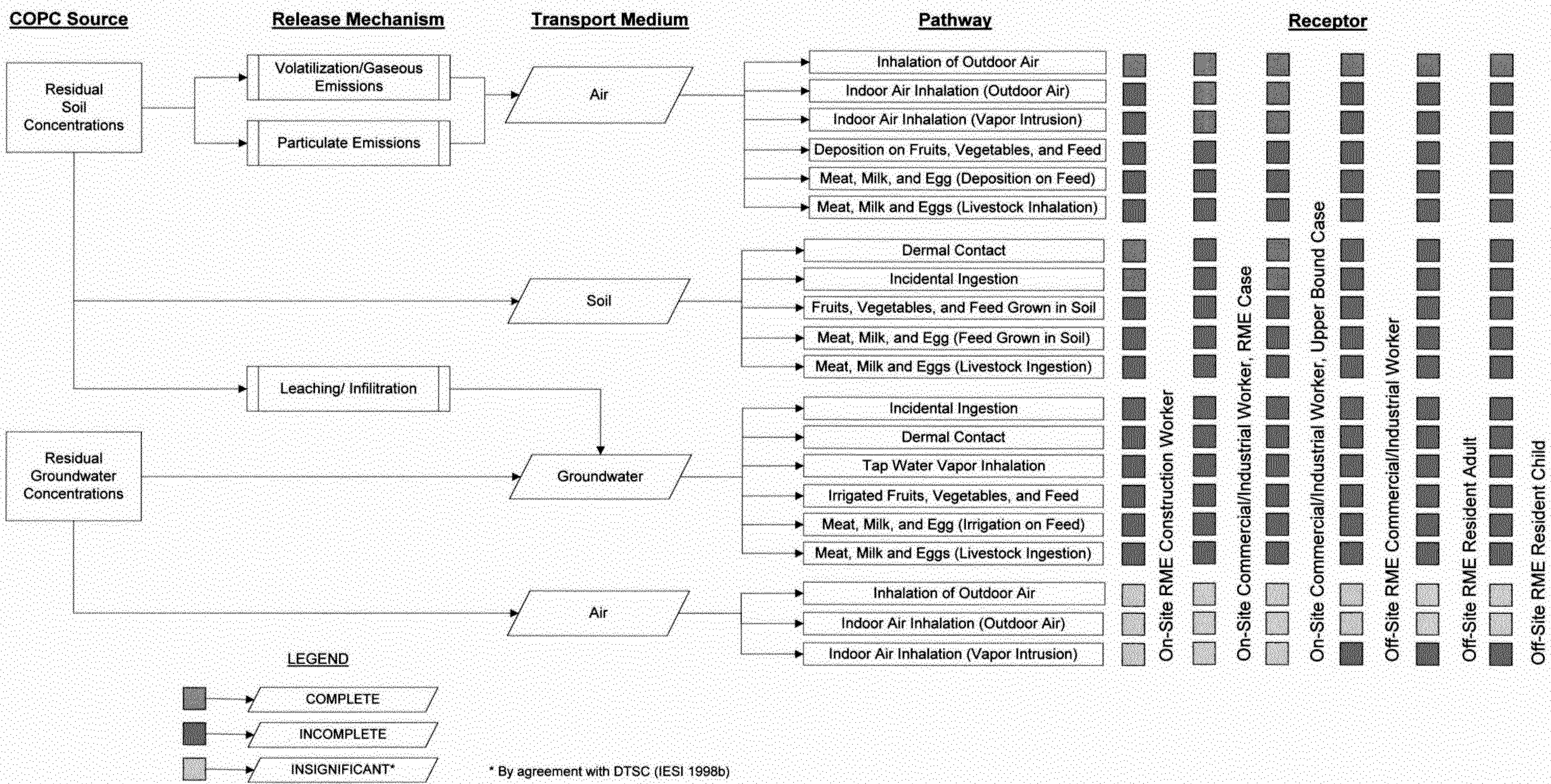

FIGURE 4-1
CONCEPTUAL EXPOSURE MODEL (CEM),
POST-DEMOLITION PARCEL A